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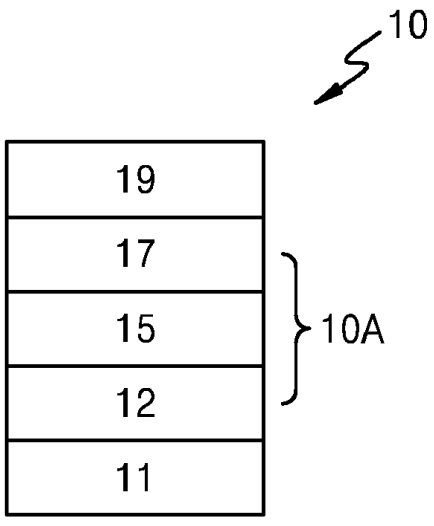
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(54) ORGANIC LIGHT-EMITTING DEVICE

(57) Provided is an organic light-emitting device including a host, a cooling dopant, and a sensitizer.

FIG. 1



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Description

FIELD OF THE INVENTION

[0001] The present disclosure relates to an organic light-emitting device including an emission layer which includes a host, a cooling dopant, and a sensitizer.

BACKGROUND OF THE INVENTION

[0002] Organic light-emitting devices are self-emission devices that produce full-color images, and also have wide viewing angles, high contrast ratios, short response times, and excellent characteristics in terms of brightness, driving voltage, and response speed, compared to devices in the art.

[0003] In an example, an organic light-emitting device includes an anode, a cathode, and an organic layer between the anode and the cathode, wherein the organic layer includes an emission layer. A hole transport region may be between the anode and the emission layer, and an electron transport region may be between the emission layer and the cathode. Holes provided from the anode may move toward the emission layer through the hole transport region, and electrons provided from the cathode may move toward the emission layer through the electron transport region. The holes and the electrons recombine in the emission layer to produce excitons. These excitons transit from an excited state to a ground state, thereby generating light.

SUMMARY OF THE INVENTION

[0004] Provided is an organic light-emitting device including an emission layer which includes a host, a cooling dopant, and a sensitizer.

[0005] Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments of the disclosure.

[0006] According to an aspect of an embodiment, an organic light-emitting device includes: a first electrode; a second electrode; and an organic layer between the first electrode and the second electrode, wherein
the organic layer may include an emission layer;
the emission layer may include a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer may include platinum (Pt):

<Condition 1>

$$T_{decay}(CD) < T_{decay}(S)$$

<Condition 2>

$$T_{decay}(CD) < 1.5\ \mu s$$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

[0007] Another aspect provides an organic light-emitting device including: a first electrode; a second electrode; and an organic layer between the first electrode and the second electrode, wherein
the organic layer may include an emission layer;
the emission layer may include a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer may include a thermally activated delayed fluorescence emitter, and
thermally activated delayed fluorescence emitter does not include metal:

<Condition 1>

$$T_{decay}(CD) < T_{decay}(S)$$

<Condition 2>

$$T_{decay}(CD) < 1.5\ \mu s$$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

[0008] According to an aspect of another embodiment, an organic light-emitting device includes: a first electrode; a second electrode; m emission units between the first electrode and the second electrode and including at least one emission layer; and
m-1 charge generating layers between neighboring two emission units of the m emission units and including an n-type charge generating layer and a p-type charge generating layer,
m may be an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission unit of the m emission units may be different from the maximum emission wavelength of light emitted from at least one emission unit of the remaining emission units,
the emission layer may include a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer may include Pt.

[0009] According to an aspect of another embodiment, an organic light-emitting device includes: a first electrode; a second electrode; m emission units between the first electrode and the second electrode and including at least one emission layer; and
m-1 charge generating layers between neighboring two emission units of the m emission units and including an n-type charge generating layer and a p-type charge generating layer,
m may be an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission unit of the m emission units may be different from the maximum emission wavelength of light emitted from at least one emission unit of the remaining emission units,
the emission layer may include a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer may include a thermally activated delayed fluorescence emitter, and
thermally activated delayed fluorescence emitter does not include metal.

[0010] According to an aspect of an embodiment, an organic light-emitting device includes: a first electrode; a second electrode; and m emission layers between the first electrode and the second electrode, wherein
m may be an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission layer of the m emission layers may be different from the maximum emission wavelength of light emitted from at least one emission layer of the remaining emission layers,
the emission layer may include a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer may include Pt.

[0011] According to an aspect of an embodiment, an organic light-emitting device includes: a first electrode; a second electrode; and m emission layers between the first electrode and the second electrode, wherein
m may be an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission layer of the m emission layers may be different from the maximum emission wavelength of light emitted from at least one emission layer of the remaining emission layers,
the emission layer may include a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and

the sensitizer may include a thermally activated delayed fluorescence emitter, and
thermally activated delayed fluorescence emitter does not include metal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other aspects, features, and advantages of certain embodiments of the disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 shows a schematic cross-sectional view of an organic light-emitting device according to an embodiment;
FIGS. 2A to 2C each show a diagram schematically illustrating energy transfer in an emission layer of an organic light-emitting device according to an embodiment;
FIG. 3 is a schematic cross-sectional view of an organic light-emitting device according to another embodiment; and
FIG. 4 is a schematic cross-sectional view of an organic light-emitting device according to another embodiment;
FIG. 5 is a graph of luminance versus external quantum efficiency of the organic light-emitting devices manufactured according to Example 3 and Comparative Example 3P; and
FIG. 6 is a graph of relative luminance versus relative lifespan of the organic light-emitting devices manufactured according to Example 3 and Comparative Example 3P.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0013] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the present embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. Expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

Description of FIGS. 1 and 2A to 2C

[0014] FIG. 1 is a schematic view of an organic light-emitting device 10 according to an embodiment. Hereinafter, a structure and a manufacturing method of an organic light-emitting device according to an example of the present disclosure will be described with reference to FIG. 1.

[0015] The organic light-emitting device 10 of FIG. 1 includes a first electrode 11, a second electrode 19 facing the first electrode 11, and an organic layer 10A between the first electrode 11 and the second electrode 19.

[0016] The organic layer 10A includes an emission layer 15, a hole transport region 12 may be located between the first electrode 11 and the emission layer 15, and an electron transport region 17 may be located between the emission layer 15 and the second electrodes 19.

[0017] A substrate may be additionally located under the first electrode 11 or above the second electrode 19. For use as the substrate, any substrate that is used in organic light-emitting devices available in the art may be used, and the substrate may be a glass substrate or a transparent plastic substrate, each having excellent mechanical strength, thermal stability, transparency, surface smoothness, ease of handling, and water resistance.

[First electrode 11]

[0018] In one or more embodiments, the first electrode 11 may be formed by depositing or sputtering a material for forming the first electrode11 on the substrate. The first electrode 11 may be an anode. The material for forming the first electrode 11 may be selected from materials with a high work function to facilitate hole injection.

[0019] The first electrode 11 may be a reflective electrode, a semi-transmissive electrode, or a transmissive electrode. When the first electrode 11 is a transmissive electrode, a material for forming a first electrode may be selected from indium tin oxide (ITO), indium zinc oxide (IZO), tin oxide (SnO_2), zinc oxide (ZnO), and any combinations thereof, but embodiments of the present disclosure are not limited thereto. In one or more embodiments, when the first electrode 110 is a semi-transmissive electrode or a reflectable electrode, a material for forming a first electrode may be selected from magnesium (Mg), silver (Ag), aluminum (Al), aluminum-lithium (Al-Li), calcium (Ca), magnesium-indium (Mg-In), magnesium-silver (Mg-Ag), and any combinations thereof, but embodiments of the present disclosure are not limited thereto.

[0020] The first electrode 11 may have a single-layered structure or a multi-layered structure including two or more layers.

[Emission layer 15]

[0021] The emission layer 15 may include a host, a cooling dopant, and a sensitizer.

[0022] The emission layer may emit fluorescent light. That is, the cooling dopant may be a material that may emit fluorescent light. The emission layer 15, which emits the fluorescent light, is clearly distinguished from an emission layer of the related art that emits phosphorescent light.

[0023] In an embodiment, the emission layer may include a host, a cooling dopant, and a sensitizer,
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer may include Pt:

<Condition 1>

$$T_{decay}(CD) < T_{decay}(S)$$

<Condition 2>

$$T_{decay}(CD) < 1.5\ \mu s$$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

[0024] The decay time of the cooling dopant is calculated from a time-resolved photoluminescence spectrum (TRPL) at room temperature with respect to a 40 nm-thickness film (hereinafter referred to as "Film (CD)") obtained by vacuum-codepositing the host and the dopant comprised in the emission layer at the weight ratio of 90:10 on a quartz substrate at the vacuum degree of 10^{-7} torr.

[0025] The decay time of the sensitizer is calculated from TRPL at room temperature with respect to a 40 nm-thickness film (hereinafter referred to as "Film (S)") obtained by vacuum-codepositing the host and the sensitizer comprised in the emission layer at the weight ratio of 90:10 on a quartz substrate at the vacuum degree of 10^{-7} torr.

[0026] The detailed evaluation method of the decay time of each of the cooling dopant and the sensitizer may be understood by referring to the following examples.

[0027] In general, it is known that since triplet excitons remain long in an excited state, they influence the decrease in the lifespan of organic light-emitting devices. However, according to the present disclosure, the cooling dopant is used to reduce the time during which the triplet excitons of the sensitizer remains in the excited state. Accordingly, an organic light-emitting device including the cooling dopant may have a prolonged lifespan.

[0028] In one embodiment, the more triplet excitons the sensitizer has, the more excess energy is accumulated in the sensitizer, resulting in more hot excitons. That is, the amount of triplet excitons of the sensitizer is proportional to the amount of hot excitons. The hot excitons break down various chemical bonds of a compound included in an emission layer and/or a compound existing at the interface of the emission layer and other layers to degrade the compound. Accordingly, the lifespan of organic light-emitting devices may be reduced. However, according to the present disclosure, by using cooling dopants, the triplet excitons of the sensitizer can be quickly converted to singlet excitons of the cooling dopant, ultimately reducing the amount of hot excitons and increasing the lifespan of an organic light-emitting device.

[0029] In this regard, "hot excitons" may be generated or increased by exciton-exciton annihilation due to an increase in the density of excitons in an emission layer, exciton-charge annihilation due to the charge imbalance in an emission layer, and/or radical ion pairs due to the delivery of electrons between a host and dopant.

[0030] In order to quickly convert triplet excitons of the sensitizer to singlet excitons of the cooling dopant, Condition 1 should be satisfied.

[0031] In addition, since the cooling dopant emits fluorescent light, a high color purity organic light-emitting device can be provided, and in particular, since Condition 2 is satisfied, so that the singlet excitons of the cooling dopant excited state at room temperature can be rapidly transferred, and thus, the single state of the cooling dopant in the excited state may not be accumulated, and the lifespan of an organic light-emitting device may be increased.

[0032] In addition, when Condition 3 is further satisfied, the transition from the triplet excitons of the sensitizer to the singlet excitons of the cooling dopant may occur more smoothly. Accordingly, the lifespan of an organic light-emitting device may be further prolonged:

<Condition 3>

$$T_{decay}(CD) / T_{decay}(S) < 0.5$$

wherein, in Condition 3,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

[0033] In one or more embodiments, the organic light-emitting device may further satisfy Condition 4:

<Condition 4>

$$BDE(S) - T_1(S) < 3.0\ eV$$

wherein, in Condition 4,

BDE (S) is the bond dissociation energy level of the sensitizer, and
T_1 (S) is the lowest excitation triplet energy level of the sensitizer.

[0034] Ultimately, the organic light-emitting device may have the target level of lifespan by satisfying Condition 5 below:

<Condition 5>

$$R(Hex)/e^{10} < 15$$

wherein, in Condition 5,
R (Hex) is the production rate of hot excitons.

[0035] In this regard, R (Hex) was subjected to the photochemical stability of the organic light-emitting device (photochemical stability), and then calculated through the Gaussian 09 program according to Equation C below.

<Equation C>

$$R(Hex) = a \square T_{decay}(S) \square e^{-(BDE(S) - T_1(S))}$$

wherein, in Equation C,

a is an arbitrarily constant,
$T_{decay}(S)$ is a decay time of the sensitizer,
BDE (S) is the bond dissociation energy level of the sensitizer, and
T_1 (S) is the lowest excitation triplet energy level of the sensitizer.

[0036] The hot-exciton production rate is estimated to be proportional to (decay time) □ $e^{-(BDE-T1)}$, and in order to obtain the target level of the lifespan of the organic light-emitting device, (hot-exciton production rate)/e^{10} should be less than 15.

[0037] In this regard, the degradation analysis (PCS) of organic light-emitting devices was calculated according to the following Equation P:

<Equation P>

$$PCS\ (\%) = I_2 / I_1 \times 100$$

wherein, in Equation P,

I_1, with respect to a film formed by depositing a compound of which PCS is to be measured, is a maximum light intensity obtained from the PL spectrum which is evaluated at room temperature under Ar atmosphere where outside air is blocked immediately after the formation of the film by using a He-Cd laser (excitation wavelength = 325 nanometers, laser power density = 100 mW/cm^2) of KIMMON-KOHA Inc., and

I_2, with respect to a film formed by depositing a compound of which PCS is to be measured, is a maximum light intensity obtained from the PL spectrum which is evaluated at room temperature under Ar atmosphere where outside air is blocked, by exposing the film to light of the He-Cd laser (excitation wavelength = 325 nanometers and laser power density = 100 mW/cm^2) of KIMMON-KOHA Inc., which is a pumping laser which has been used to evaluate I_1, for 3 hours, and then, using He-Cd laser of KIMMON-KOHA Inc. (excitation wavelength = 325 nanometers). In the case of the sensitizer, reverse intersystem crossing (RISC) and/or intersystem crossing (ISC) actively occur, which allows excitons generated at the host to be delivered to the cooling dopant.

[0038] Specifically, the general energy transfer of an organic light-emitting device according to an embodiment will be described with reference to FIG. 2A.

[0039] Singlet and triplet excitons are formed at the host in the emission layer, and the singlet and triplet excitons formed at the host are transferred to the sensitizer and then to the cooling dopant through Forster energy transfer (FRET). At this time, in order to embody the high efficiency and long lifespan of the organic light-emitting device, it is necessary to control the hot excitons generated in the emission layer, which requires optimization of energy transfer.

[0040] Specifically, the general energy transfer of an organic light-emitting device (type I) according to an embodiment will be described with reference to FIG. 2B. This is the case when the sensitizer is a thermally activated delayed fluorescence (TADF) emitter satisfying the condition of $\Delta E_{ST} \leq 0.3$ eV.

[0041] The singlet excitons formed at the host, which is 25% of the total excitons, are transferred to the sensitizer through FRET, and the energy of triplet excitons formed at the host, which is 75% of the total excitons, is transferred to the singlet and triplet of the sensitizer, among which the energy delivered to triplet is subjected to RISC into singlet, and then, the singlet energy of the sensitizer is transferred to the cooling dopant through FRET.

[0042] Specifically, the general energy transfer of an organic light-emitting device (type II) according to an embodiment will be described with reference to FIG. 2C. In this case, the sensitizer is an organic metallic compound including Pt.

[0043] The triplet excitons formed at the host, which is 75% of the total excitons, are transferred to the sensitizer through Dexter energy transfer, and the energy of singlet excitons formed at the host, which is 25% of the total excitons, is transferred to the singlet and triplet of the sensitizer, among which the energy delivered to singlet is subjected to ISC into triplet, and then, the triplet energy of the sensitizer is transferred to the cooling dopant through FRET.

[0044] Accordingly, by transferring all the singlet excitons and triplet excitons generated in the emission layer to the dopant, an organic light-emitting device having improved efficiency can be obtained. In addition, since an organic light-emitting device can be obtained with significantly reduced energy loss, the lifespan characteristics of the organic light-emitting device can be improved.

[0045] The amount of the sensitizer in the emission layer may be from about 5 wt% to about 50 wt%. Within these ranges, it is possible to achieve effective energy transfer in the emission layer, and accordingly, an organic light-emitting device having high efficiency and long lifespan can be obtained.

[0046] In one embodiment, the host, the cooling dopant, and the sensitizer may further satisfy Condition 6:

<Condition 6>

$$T_1(H) \geq T_1(S) \geq S_1(CD)$$

wherein, in Condition 6,

$T_1(H)$ is the lowest excitation triplet energy level of the host,
$S_1(CD)$ is the lowest excitation singlet energy level of the cooling dopant, and
$T_1(S)$ is the lowest excitation triplet energy level of the sensitizer.

[0047] When the host, the cooling dopant, and the sensitizer each satisfy Condition 6, triplet excitons may be effectively transferred from the emission layer to the cooling dopant, and thus, an organic light-emitting device having improved efficiency may be obtained.

[0048] The emission layer may consist of the host, the cooling dopant, and the sensitizer. That is, the emission layer may not further include materials other than the host, the cooling dopant, and the sensitizer.

[0049] A thickness of the emission layer may be in a range of about 100 Å to about 1,000 Å, for example, about 200 Å to about 600 Å. When the thickness of the emission layer is within this range, excellent light-emission characteristics

may be obtained without a substantial increase in driving voltage.

[Host in emission layer 15]

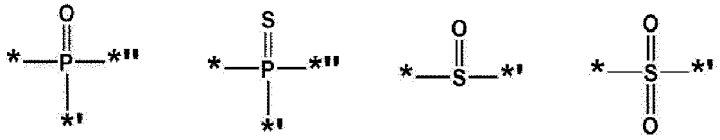
[0050] The host may include no metal atoms.

[0051] In one or more embodiments, the host may include one kind of host. When the host includes one host, the one host may be selected from an amphiprotic host, an electron transport host, and a hole transport host, which will be described later.

[0052] In one or more embodiments, the host may include a mixture of two or more different hosts. For example, the host may be a mixture of an electron transport host and a hole transport host, a mixture of two types of electron transport hosts different from each other, or a mixture of two types of hole transport hosts different from each other. The electron transport host and the hole transport host may be understood by referring to the related description to be presented later.

[0053] In one or more embodiments, the host may include an electron transport host including at least one electron transport moiety and a hole transport host that is free of an electron transport moiety.

[0054] The electron transport moiety used herein may be selected from a cyano group, a Π electron-deficient nitrogen-containing cyclic group, and a group represented by one of the following Formulae:



[0055] In the formulae, *, *', and *'' are each binding sites to neighboring atoms.

[0056] In one or more embodiments, the electron transport host of the emission layer 15 may include at least one of a cyano group and a Π electron-deficient nitrogen-containing cyclic group.

[0057] In one or more embodiments, the electron transport host in the emission layer 15 may include at least one cyano group.

[0058] In one or more embodiments, the electron transport host in the emission layer 15 may include at least one cyano group and at least one Π electron deficient nitrogen-containing cyclic group.

[0059] In one or more embodiments, the host may include an electron transport host and a hole transport host, wherein the electron transport host may include at least one Π electron-deficient nitrogen-free cyclic group and at least one electron transport moiety, and the hole transport host may include at least one Π electron-deficient nitrogen-free cyclic group and may not include an electron transport moiety.

[0060] The term "Π electron-deficient nitrogen-containing cyclic group" used herein refers to a cyclic group having at least one *-N=*' moiety, and for example, may be selected from an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyridazine group, a pyrimidine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, and an azacarbazole group; and a condensed cyclic group in which two or more Π electron-deficient nitrogen-containing cyclic groups.

[0061] Meanwhile, the Π electron-deficient nitrogen-free cyclic group may be selected from a benzene group, a heptalene group, an indene group, a naphthalene group, an azulene group, an indacene group, acenaphthylene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentacene group, a hexacene group, a pentaphene group, a rubicene group, a coronene group, an ovalene group, a pyrrole group, an isoindole group, an indole group, a furan group, a thiophene group, a benzofuran group, a benzothiophene group, a benzocarbazole group, a dibenzocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzothiophene sulfone group, a carbazole group, a dibenzosilole group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, a benzothienocarbazole group, a triindolobenzene group; and a condensed cyclic group of two or more Π electron-deficient nitrogen-free cyclic groups, but embodiments of the present disclosure are not limited thereto.

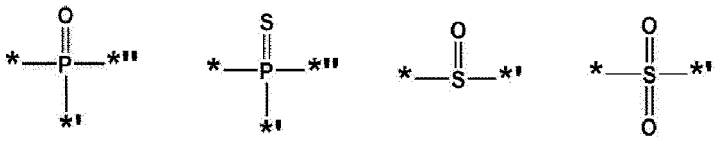
[0062] In one or more embodiments, the electron transport host may be selected from compounds represented by Formula E-1, and

the hole transport host may be selected from compounds represented by Formula H-1, but embodiments of the present disclosure are not limited thereto:

<Formula E-1> $[Ar_{301}]_{xb11}-[(L_{301})_{xb1}-R_{301}]_{xb21}$

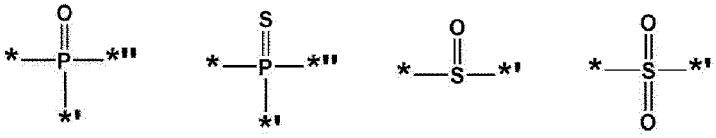
wherein, in Formula E-1,

Ar_{301} may be selected from a substituted or unsubstituted C_5-C_{60} carbocyclic group and a substituted or unsubstituted C_1-C_{60} heterocyclic group,
xb11 may be 1, 2, or 3,
L_{301} may each independently be selected from a single bond, a group represented by the following formula , a substituted or unsubstituted C_5-C_{60} carbocyclic group, and a substituted or unsubstituted C_1-C_{60} heterocyclic group, and *, *' and *'' in the following formulae are each a binding site to a neighboring atom,



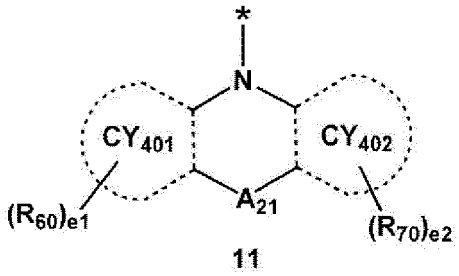
xb1 may be an integer from 1 to 5,
R_{301} may be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a substituted or unsubstituted C_1-C_{60} alkyl group, a substituted or unsubstituted C_2-C_{60} alkenyl group, a substituted or unsubstituted C_2-C_{60} alkynyl group, a substituted or unsubstituted C_1-C_{60} alkoxy group, a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10}heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group, $-Si(Q_{301})(Q_{302})(Q_{303})$, $-N(Q_{301})(Q_{302})$, $-B(Q_{301})(Q_{302})$, $-C(=O)(Q_{301})$, $-S(=O)_2(Q_{301})$, $-S(=O)(Q_{301})$, $-P(=O)(Q_{301})(Q_{302})$, and $-P(=S)(Q_{301})(Q_{302})$,
xb21 may be an integer from 1 to 5,
Q_{301} to Q_{303} are each independently be selected from a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, and a naphthyl group, and
at least one of <Condition A> to <Condition C> is satisfied:

<Condition A>
Ar_{301}, L_{301}, and R_{301} in Formula E-1 may each independently include a Π electron-deficient nitrogen-containing cyclic group.
<Condition B>
L_{301} in Formula E-1 is a group represented by the following groups:

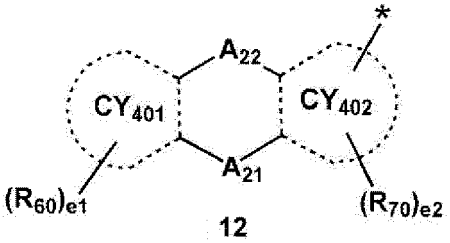


<Condition C>
R_{301} in Formula E-1 may be selected from a cyano group, $-S(=O)_2(Q_{301})$, $-S(=O)(Q_{301})$, $-P(=O)(Q_{301})(Q_{302})$, and $-P(=S)(Q_{301})(Q_{302})$.

<Formula H-1 > $Ar_{401}-(L_{401})_{xd1}-(Ar_{402})_{xd11}$



11



12

wherein, in Formulae H-1, 11, and 12,
L_{401} may be selected from:

a single bond; and
a benzene group, a heptalene group, an indene group, a naphthalene group, an azulene group, an indacene group, acenaphthylene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentacene group, a hexacene group, a pentaphene group, a rubicene group, a coronene group, an ovalene group, a pyrrole group, an isoindole group, an indole group, a furan group, a thiophene group, a benzofuran group, a benzothiophene group, a benzocarbazole group, a dibenzocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzothiophene sulfone group, a carbazole group, a dibenzosilole group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, a benzothienocarbazole group, and a triindolobenzene group, each unsubstituted or substituted with at least one selected from deuterium, a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a triphenylenyl group, a biphenyl group, a terphenyl group, a tetraphenyl group, and $-Si(Q_{401})(Q_{402})(Q_{403})$;
xd1 may be an integer from 1 to 10, wherein when xd1 is 2 or more, two or more of L_{401}(s) may be identical to or different from each other,
Ar_{401} may be selected from groups represented by Formulae 11 and 12,
Ar_{402} may be selected from:

groups represented by Formula 11 and 12, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a biphenyl group, a terphenyl group, and a triphenylenyl group; and
a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a biphenyl group, a terphenyl group, and a triphenylenyl group, each substituted with at least one selected from deuterium, a hydroxyl group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a biphenyl group, a terphenyl group, and a triphenylenyl group;
xd11 may be an integer from 1 to 10, wherein when xd11 is 2 or more, two or more of Ar_{402} (s) may be identical to or different from each other;
CY_{401} and CY_{402} may each independently be selected from a benzene group, a naphthalene group, a fluorene group, a carbazole group, a benzocarbazole group, an indolocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzosilole group, a benzonaphthofuran group, a benzonaphthothiophene group, and a benzonaphthosilole group,
A21 is selected from a single bond, O, S, $N(R_{51})$, $C(R_{51})(R_{52})$, and $Si(R_{51})(R_{52})$,
A22 is selected from a single bond, O, S, $N(R_{53})$, $C(R_{53})(R_{54})$, and $Si(R_{53})(R_{54})$,
at least one selected from A_{21} and A_{22} in Formula 12 is not a single bond,
R_{51} to R_{54}, R_{60}, and R_{70} are each independently selected from:

hydrogen, deuterium, a hydroxyl group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid group or a salt thereof, a sulfonic acid group or a salt thereof, a phosphoric acid group or a salt thereof, a C_1-C_{20} alkyl group, and a C_1-C_{20} alkoxy group;
a C_1-C_{20} alkyl group and a C_1-C_{20} alkoxy group, each substituted with at least one selected from deuterium, a hydroxyl group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid group or a salt thereof, a sulfonic acid group or a salt thereof, a phosphoric acid group or a salt thereof,

a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, and a dibenzothiophenyl group;

a π electron-deficient nitrogen-free cyclic group (for example, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a biphenyl group, a terphenyl group, and a triphenylenyl group);

a π electron-deficient nitrogen-free cyclic group (for example, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a biphenyl group, a terphenyl group, and a triphenylenyl group), each substituted with at least one selected from deuterium, a hydroxyl group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, and a biphenyl group; and

$-Si(Q_{404})(Q_{405})(Q_{406})$,

e1 and e2 may each independently be an integer from 0 to 10,

Q_{401} to Q_{406} may each independently be selected from hydrogen, deuterium, a hydroxyl group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a biphenyl group, a terphenyl group, and a triphenylenyl group, and

* indicates a binding site to a neighboring atom.

[0063] In one or more embodiments, Ar_{301} and L_{301} in Formula E-1 may each independently be selected from a benzene group, a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a dibenzofuran group, a dibenzothiophene group, an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyridazine group, a pyrimidine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, and an azacarbazole group, each unsubstituted or substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, a cyano-containing naphthyl group, a pyridinyl group, a phenylpyridinyl group, a diphenylpyridinyl group, a biphenylpyridinyl group, a di(biphenyl)pyridinyl group, a pyrazinyl group, a phenylpyrazinyl group, a diphenylpyrazinyl group, a biphenylpyrazinyl group, a di(biphenyl)pyrazinyl group, a pyridazinyl group, a phenylpyridazinyl group, a diphenylpyridazinyl group, a biphenylpyridazinyl group, a di(biphenyl)pyridazinyl group, a pyrimidinyl group, a phenylpyrimidinyl group, a diphenylpyrimidinyl group, a biphenylpyrimidinyl group, a di(biphenyl)pyrimidinyl group, a triazinyl group, a phenyltriazinyl group, a diphenyltriazinyl group, a biphenyltriazinyl group, a di(biphenyl)triazinyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, $-N(Q_{31})(Q_{32})$, $-B(Q_{31})(Q_{32})$, $-C(=O)(Q_{31})$, $-S(=O)_2(Q_{31})$, and $-P(=O)(Q_{31})(Q_{32})$,

at least one of L_{301}(s) in the number of xb1 may each independently be selected from an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyridazine group, a pyrimidine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, and an azacarbazole group, each unsubstituted or substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, a cyano-containing naphthyl group, a pyridinyl group, a phenylpyridinyl group, a diphenylpyridinyl group, a biphenylpyridinyl group, a di(biphenyl)pyridinyl group, a pyrazinyl group, a phenylpyrazinyl group, a diphenylpyrazinyl group, a biphenylpyrazinyl group, a di(biphenyl)pyrazinyl group, a pyridazinyl group, a phenylpyridazinyl group, a diphenylpyridazinyl group, a biphenylpyridazinyl group, a di(biphenyl)pyridazinyl group, a pyrimidinyl group, a phenylpyrimidinyl group, a diphenylpyrimidinyl group, a

biphenylpyrimidinyl group, a di(biphenyl)pyrimidinyl group, a triazinyl group, a phenyltriazinyl group, a diphenyltriazinyl group, a biphenyltriazinyl group, a di(biphenyl)triazinyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, $-N(Q_{31})(Q_{32})$, $-B(Q_{31})(Q_{32})$, $-C(=O)(Q_{31})$, $-S(=O)_2(CH_{31})$, and $-P(=O)(Q_{31})(Q_{32})$, and

R_{301} may be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a tetraphenyl group, a naphthyl group, a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, a cyano-containing tetraphenyl group, a cyano-containing naphthyl group, a pyridinyl group, a phenylpyridinyl group, a diphenylpyridinyl group, a biphenylpyridinyl group, a di(biphenyl)pyridinyl group, a pyrazinyl group, a phenylpyrazinyl group, a diphenylpyrazinyl group, a biphenylpyrazinyl group, a di(biphenyl)pyrazinyl group, a pyridazinyl group, a phenylpyridazinyl group, a diphenylpyridazinyl group, a biphenylpyridazinyl group, a di(biphenyl)pyridazinyl group, a pyrimidinyl group, a phenylpyrimidinyl group, a diphenylpyrimidinyl group, a biphenylpyrimidinyl group, a di(biphenyl)pyrimidinyl group, a triazinyl group, a phenyltriazinyl group, a diphenyltriazinyl group, a biphenyltriazinyl group, a di(biphenyl)triazinyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, $-N(Q_{31})(Q_{32})$, $-B(Q_{31})(Q_{32})$, $-C(=O)(Q_{31})$, $-S(=O)_2(Q_{31})$, and $-P(=O)(Q_{31})(Q_{32})$,

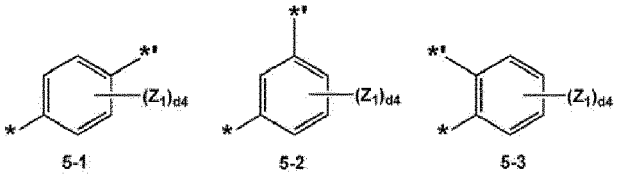
wherein Q_{31} to Q_{33} may each independently be selected from a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, and a naphthyl group, but embodiments of the present disclosure are not limited thereto.

[0064] In one or more embodiments,

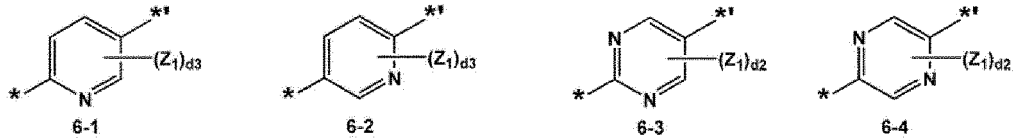
Ar_{301} may be selected from a benzene group, a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a dibenzofuran group, and a dibenzothiophene group, each unsubstituted or substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, a cyano-containing naphthyl group, a pyridinyl group, a phenylpyridinyl group, a diphenylpyridinyl group, a biphenylpyridinyl group, a di(biphenyl)pyridinyl group, a pyrazinyl group, a phenylpyrazinyl group, a diphenylpyrazinyl group, a biphenylpyrazinyl group, a di(biphenyl)pyrazinyl group, a pyridazinyl group, a phenylpyridazinyl group, a diphenylpyridazinyl group, a biphenylpyridazinyl group, a di(biphenyl)pyridazinyl group, a pyrimidinyl group, a phenylpyrimidinyl group, a diphenylpyrimidinyl group, a biphenylpyrimidinyl group, a di(biphenyl)pyrimidinyl group, a triazinyl group, a phenyltriazinyl group, a diphenyltriazinyl group, a biphenyltriazinyl group, a di(biphenyl)triazinyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, $-N(Q_{31})(Q_{32})$, $-B(Q_{31})(Q_{32})$, $-C(=O)(Q_{31})$, $-S(=O)_2(Q_{31})$, and $-P(=O)(Q_{31})(Q_{32})$; and

groups represented by Formulae 5-1 to 5-3 and Formulae 6-1 to 6-33, and

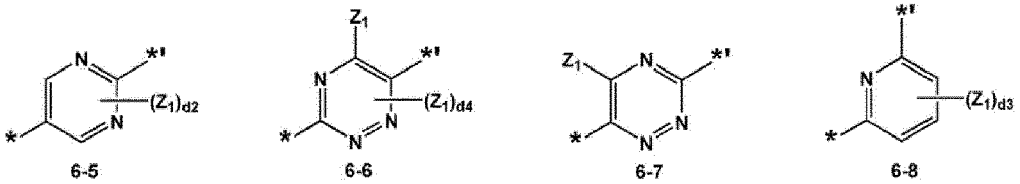
L_{301} may be selected from groups represented by Formulae 5-1 to 5-3 and Formulae 6-1 to 6-33:



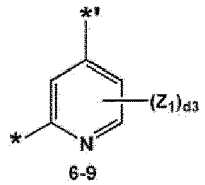
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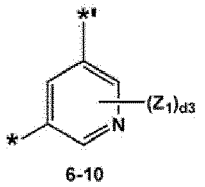


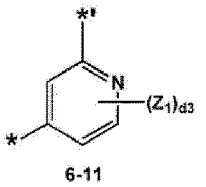
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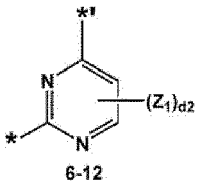


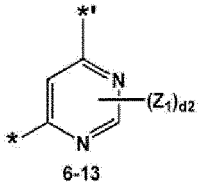
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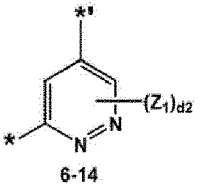

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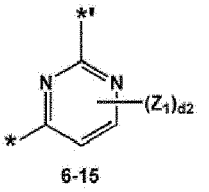

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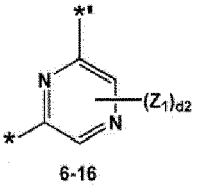

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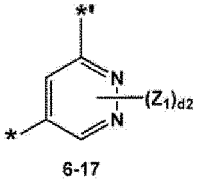

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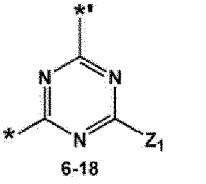

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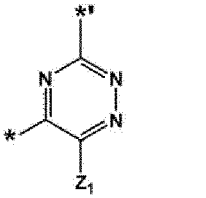

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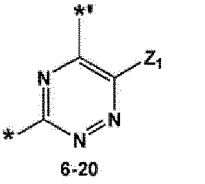

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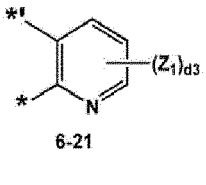

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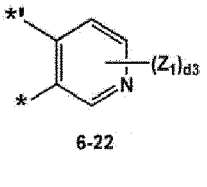

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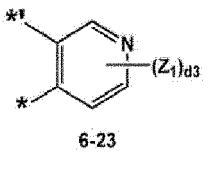

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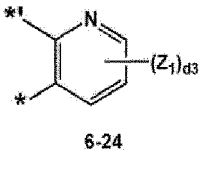

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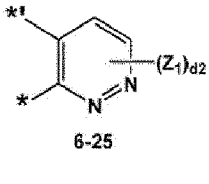

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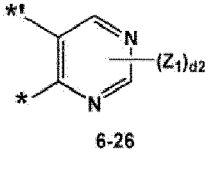

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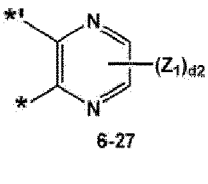

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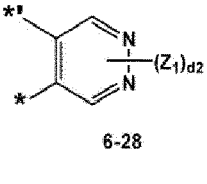

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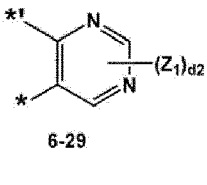

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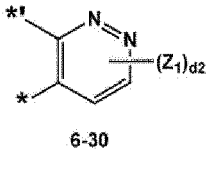

6-25

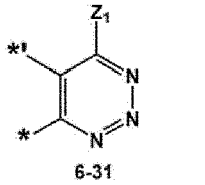

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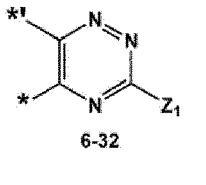

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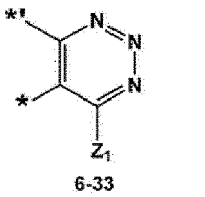

6-28


6-29


6-30


6-31


6-32


6-33

wherein, in Formulae 5-1 to 5-3 and 6-1 to 6-33,

Z_1 may be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, a cyano-containing naphthyl group, a pyridinyl group, a phenylpyridinyl group, a diphenylpyridinyl group, a biphenylpyridinyl group, a di(biphenyl)pyridinyl group, a pyrazinyl group, a phe-

nylpyrazinyl group, a diphenylpyrazinyl group, a biphenylpyrazinyl group, a di(biphenyl)pyrazinyl group, a pyridazinyl group, a phenylpyridazinyl group, a diphenylpyridazinyl group, a biphenylpyridazinyl group, a di(biphenyl)pyridazinyl group, a pyrimidinyl group, a phenylpyrimidinyl group, a diphenylpyrimidinyl group, a biphenylpyrimidinyl group, a di(biphenyl)pyrimidinyl group, a triazinyl group, a phenyltriazinyl group, a diphenyltriazinyl group, a biphenyltriazinyl group, a di(biphenyl)triazinyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, $-N(Q_{31})(Q_{32})$, $-B(Q_{31})(Q_{32})$, $-C(=O)(Q_{31})$, $-S(=O)_2(Q_{31})$, and $-P(=O)(Q_{31})(Q_{32})$,

d4 may be 0, 1, 2, 3, or 4,

d3 may be 0, 1, 2, or 3,

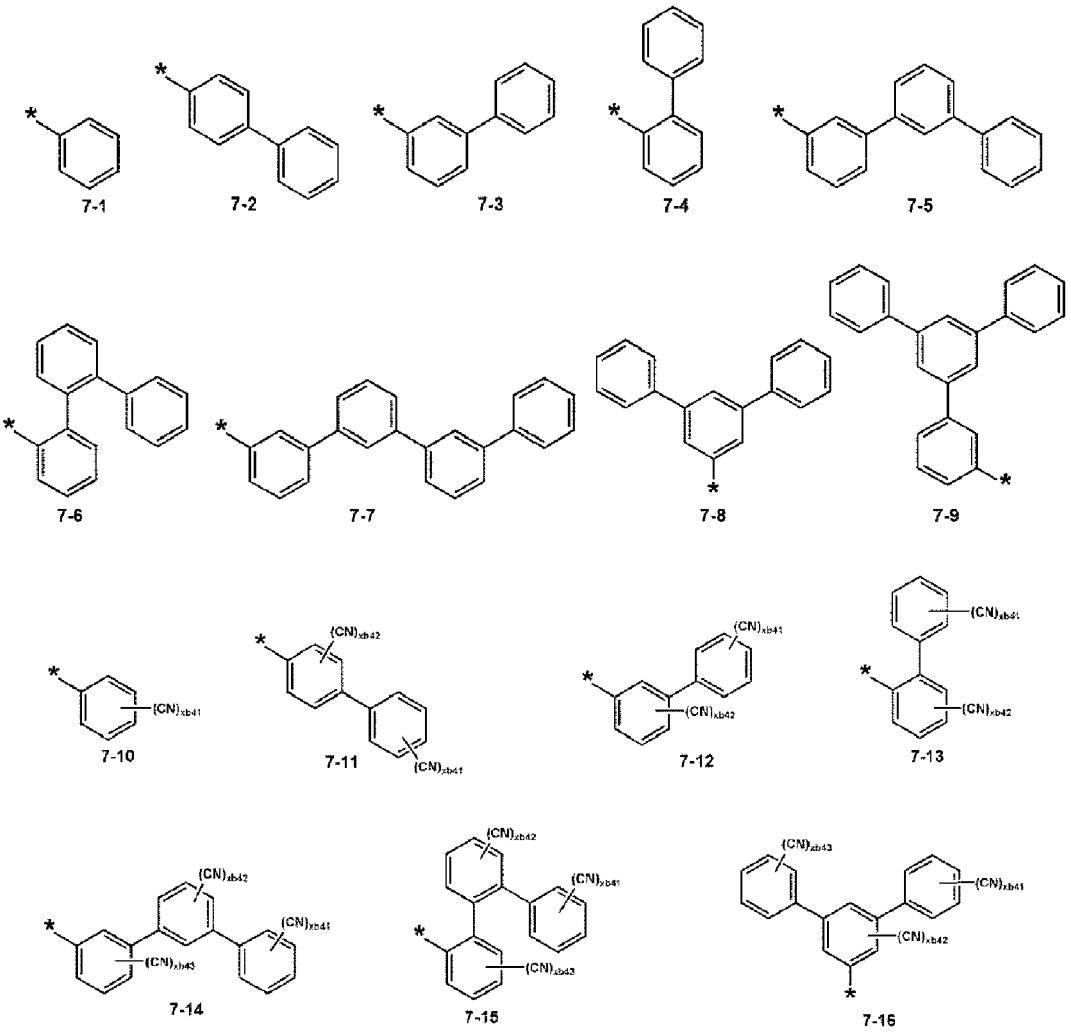
d2 may be 0, 1, or 2, and

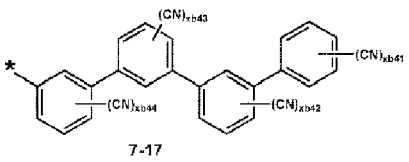
* and *' each indicate a binding site to a neighboring atom.

Q_{31} to Q_{33} are the same as described in the present specification.

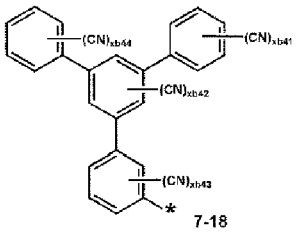
[0065] In one or more embodiments, L_{301} may be selected from groups represented by Formulae 5-2, 5-3 and 6-8 to 6-33.

[0066] In one or more embodiments, R_{301} may be selected from a cyano group and groups represented by Formula 7-1 to 7-18, and at least one of Ar_{402}(s) in the number of xd11 may be selected from groups represented by Formulae 7-1 to 7-18, but embodiments of the present disclosure are not limited thereto:





7-17



7-18

wherein, in Formulae 7-1 to 7-18,
xb41 to xb44 may each be 0, 1, or 2, wherein xb41 in Formula 7-10 is not 0, the sum of xb41 and xb42 in Formulae 7-11 to 7-13 is not 0, the sum of xb41, xb42, and xb43 in Formulae 7-14 to 7-16 is not 0, the sum of xb41, xb42, xb43, and xb44 in Formulae 7-17 and 7-18 is not 0, and * indicates a binding site to a neighboring atom.

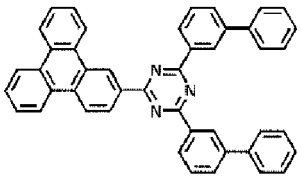
[0067] Two or more Ar_{301}(s) in Formula E-1 may be identical to or different from each other, two or more L_{301}(s) may be identical to or different from each other, two or more L_{401}(S) in Formula H-1 may be identical to or different from each other, and two or more Ar_{402}(s) in Formula H-1 may be identical to or different from each other.

[0068] In one embodiment, the electron transport host includes i) at least one of a cyano group, a pyrimidine group, a pyrazine group, and a triazine group and ii) a triphenylene group, and the hole transport host may include a carbazole group.

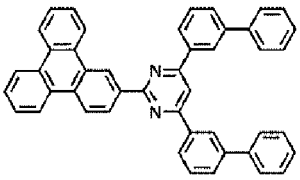
[0069] In one or more embodiments, the electron transport host may include at least one cyano group.

[0070] The electron transport host may be, for example, selected from groups HE1 to HE7, but embodiments of the present disclosure are not limited thereto:

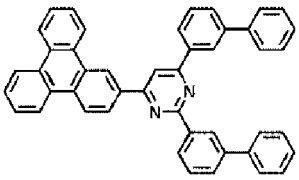
<group HE1 >



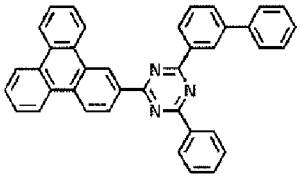
H-E1



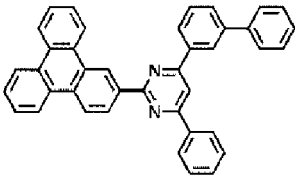
H-E2



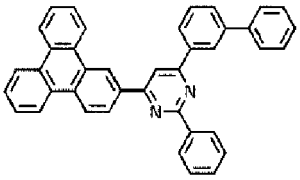
H-E3



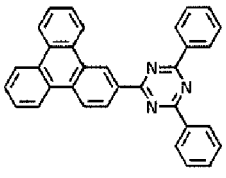
H-E4



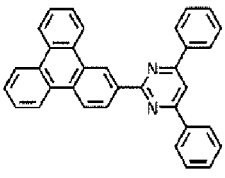
H-E5



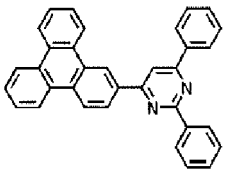
H-E6



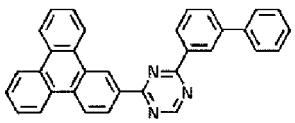
H-E7



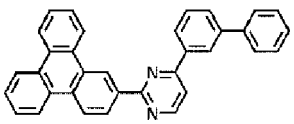
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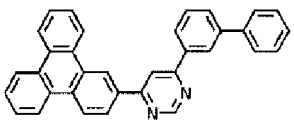
H-E9



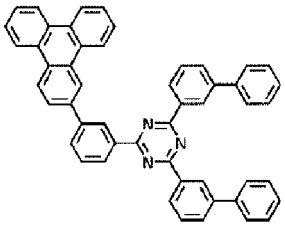
H-E10



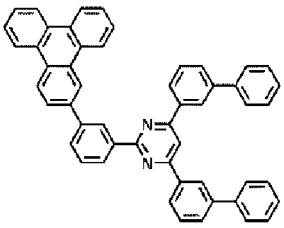
H-E11



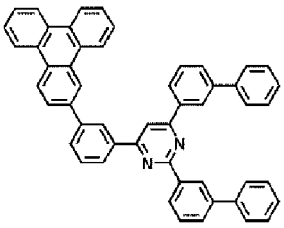
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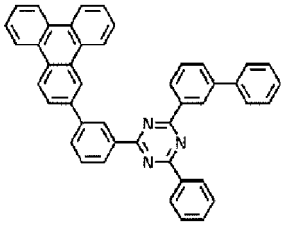
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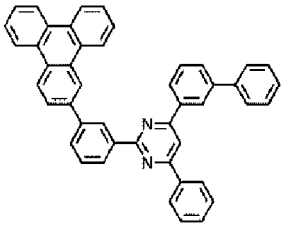
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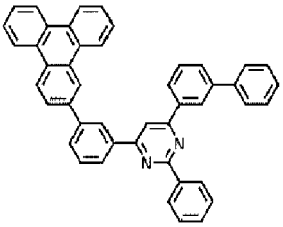
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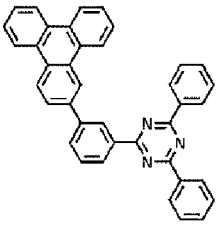
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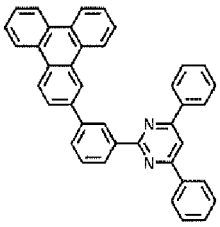
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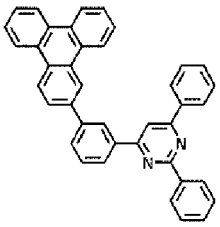
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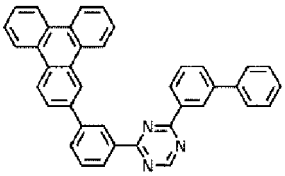
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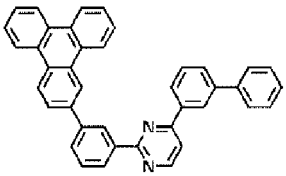
H-E20



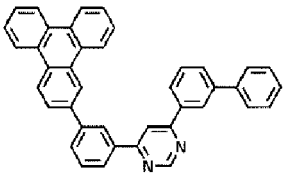
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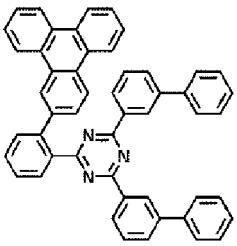
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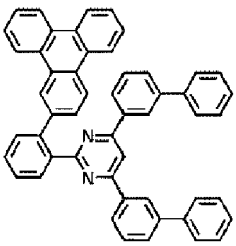
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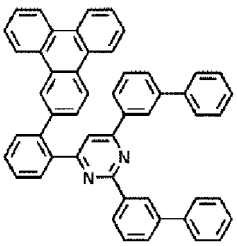
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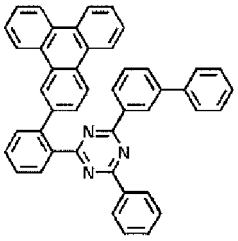
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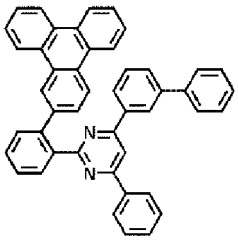
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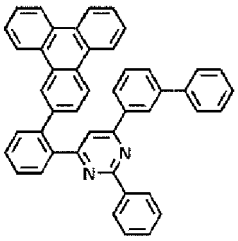
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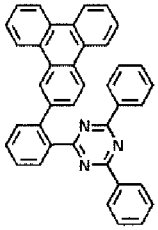
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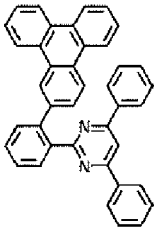
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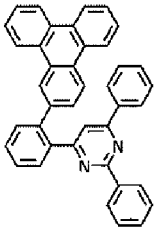
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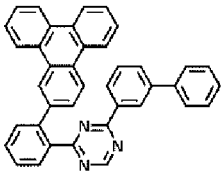
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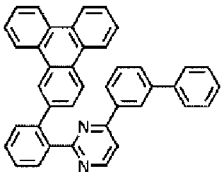
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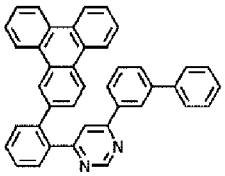
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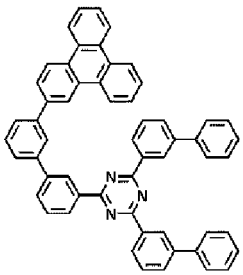
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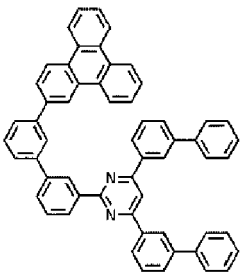
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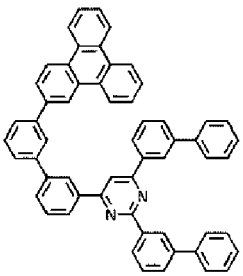
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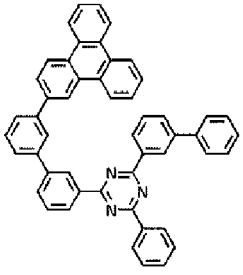
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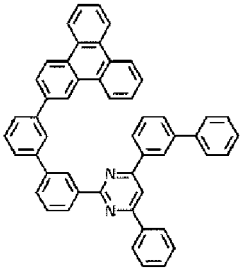
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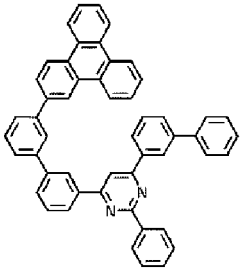
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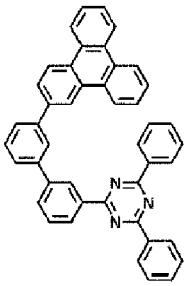
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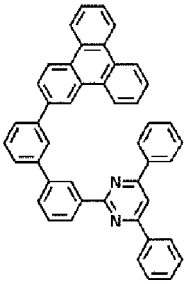
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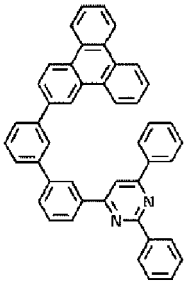
H-E42



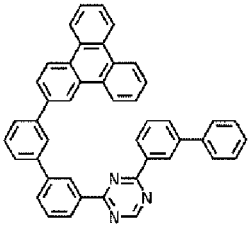
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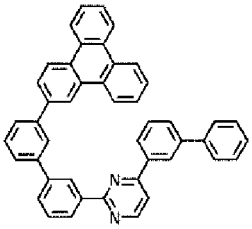
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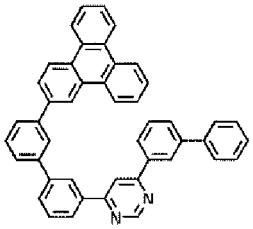
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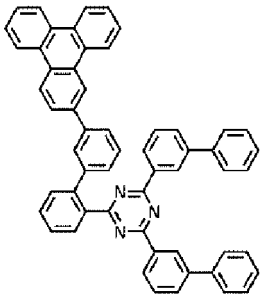
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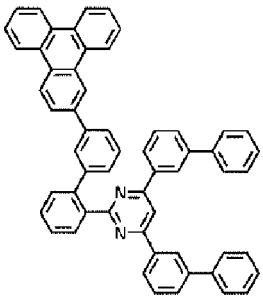
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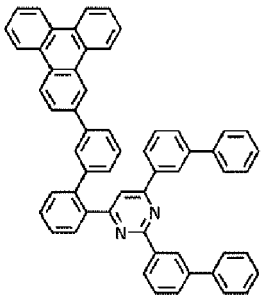
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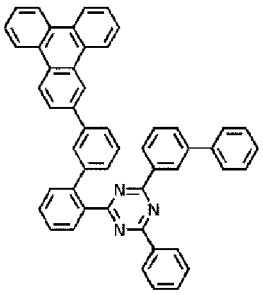
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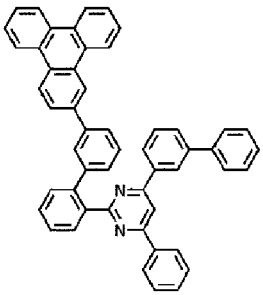
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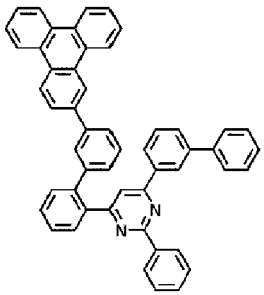
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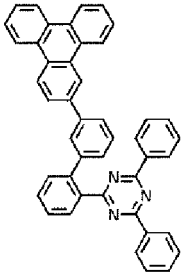
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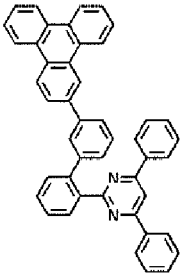
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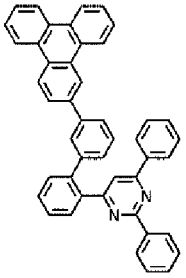
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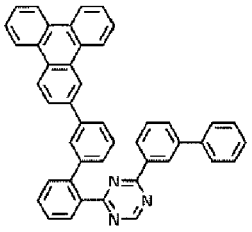
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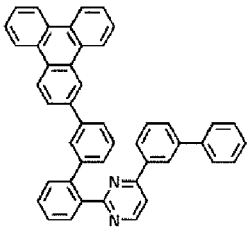
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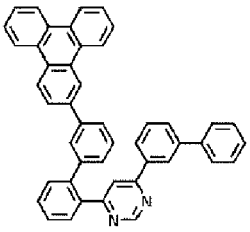
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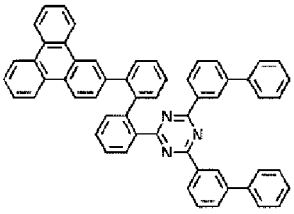
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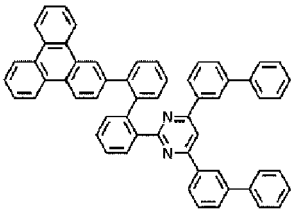
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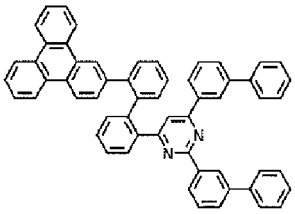
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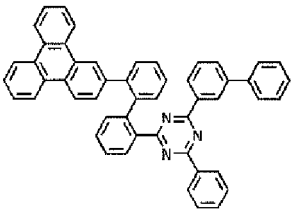
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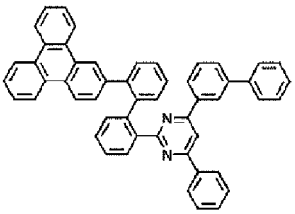
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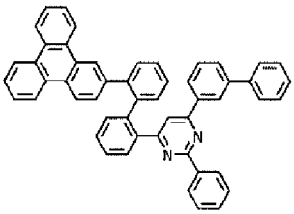
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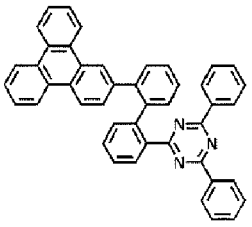
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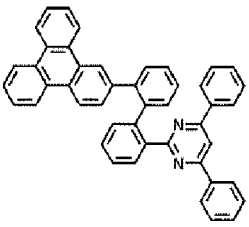
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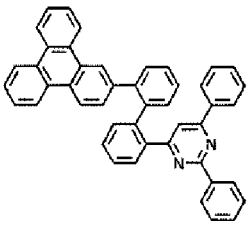
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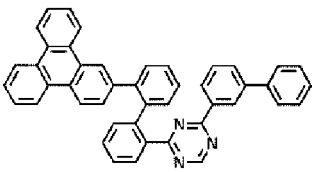
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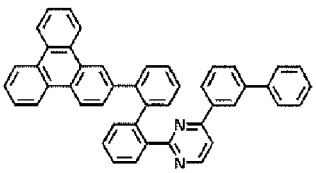
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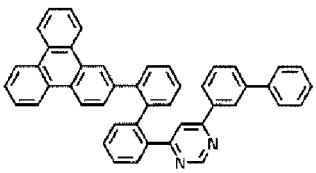
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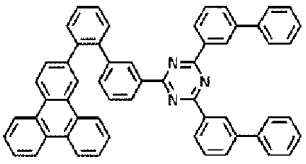
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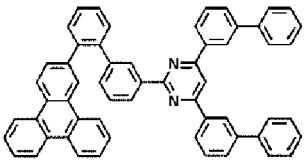
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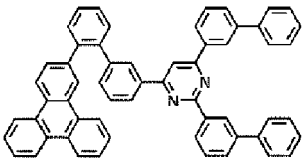
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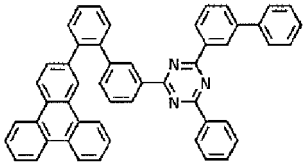
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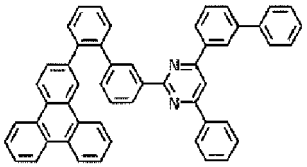
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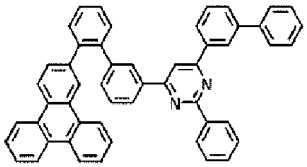
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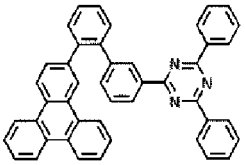
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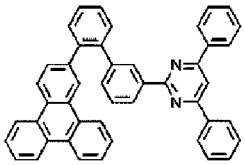
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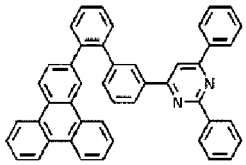
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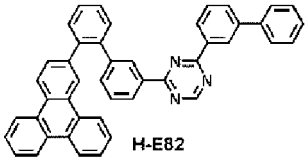
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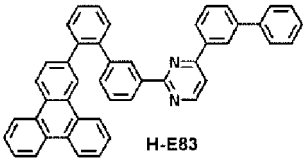
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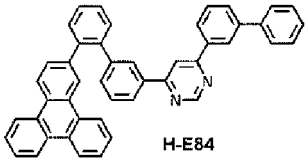
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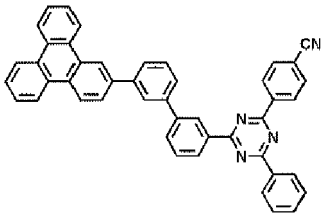
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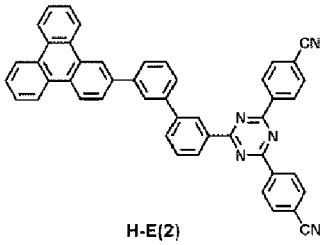
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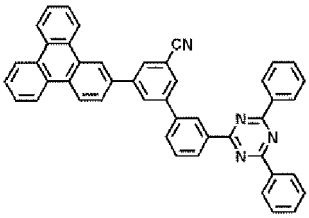
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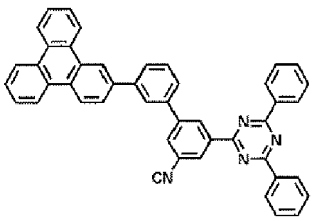
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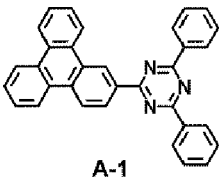
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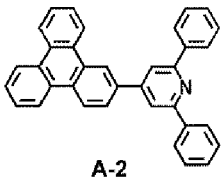
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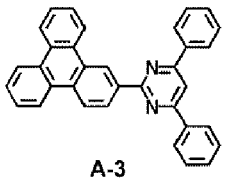
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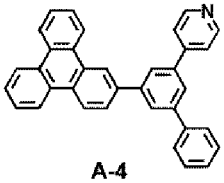
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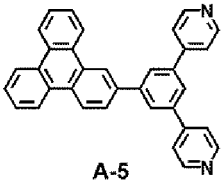
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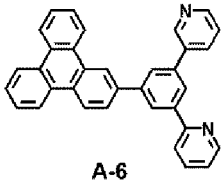
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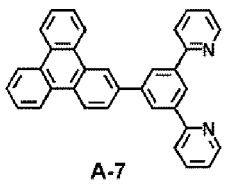
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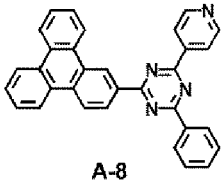
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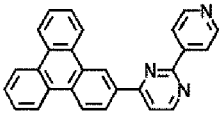
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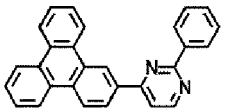
A-7



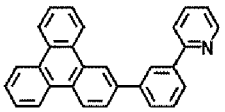
A-8



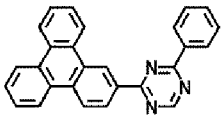
A-9



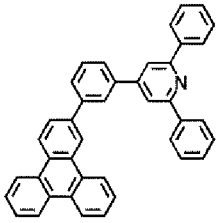
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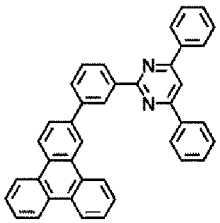
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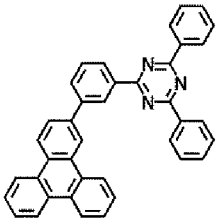
A-12



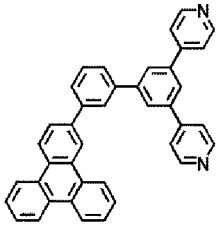
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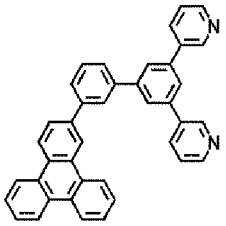
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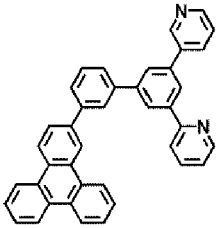
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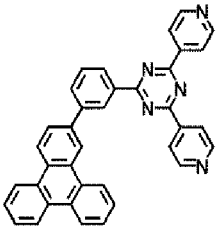
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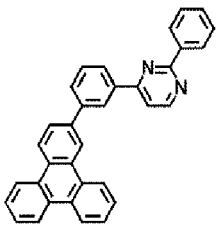
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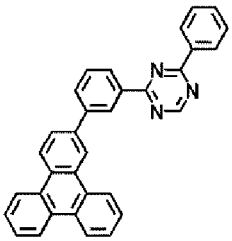
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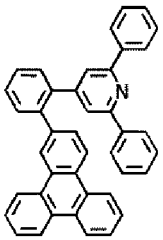
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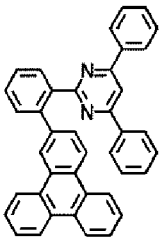
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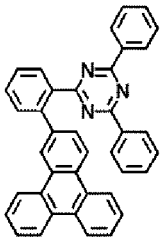
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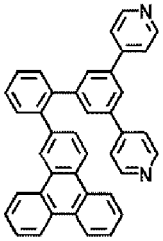
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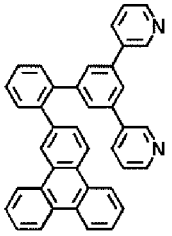
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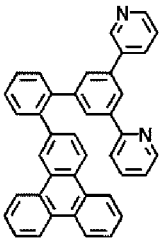
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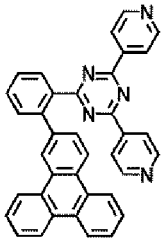
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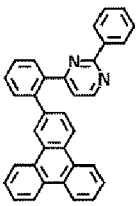
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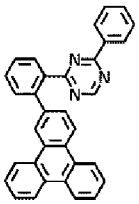
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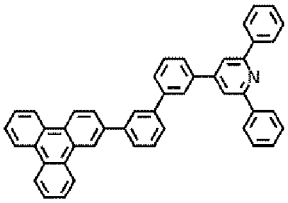
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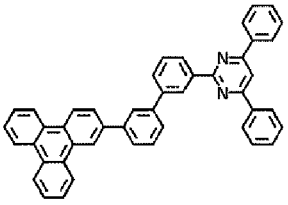
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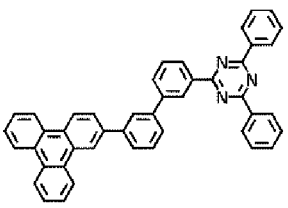
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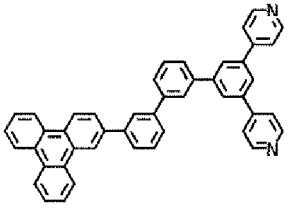
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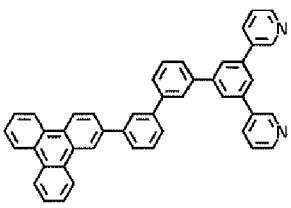
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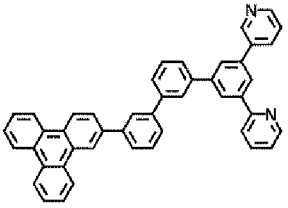
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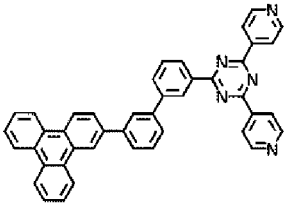
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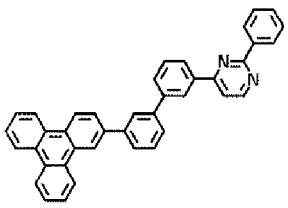
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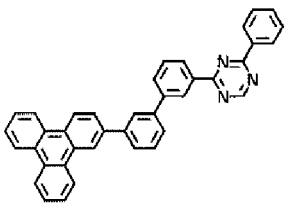
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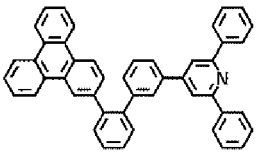
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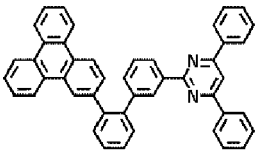
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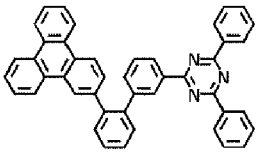
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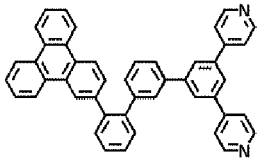
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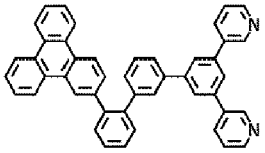
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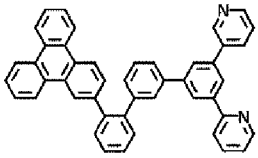
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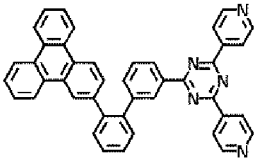
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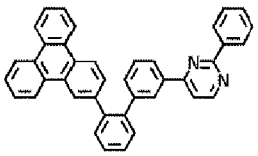
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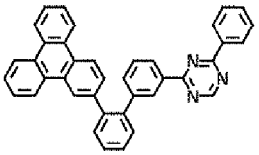
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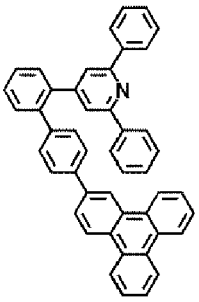
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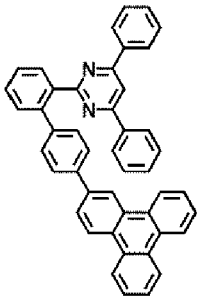
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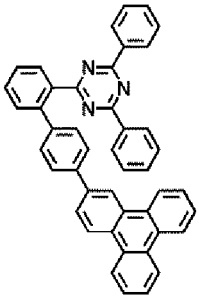
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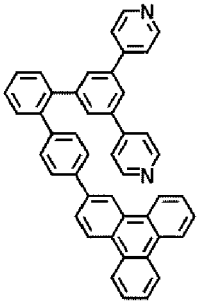
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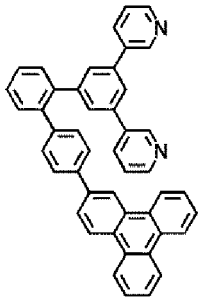
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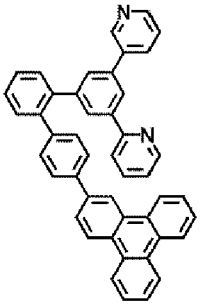
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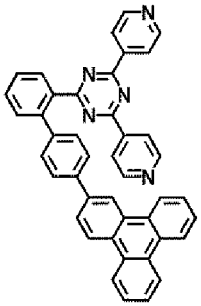
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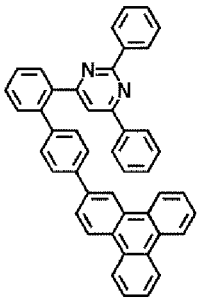
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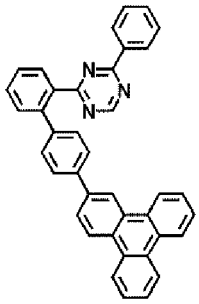
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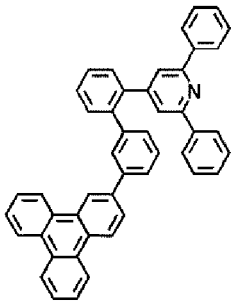
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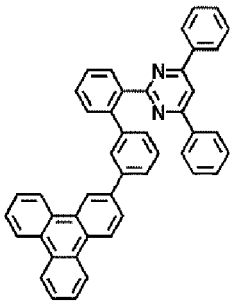
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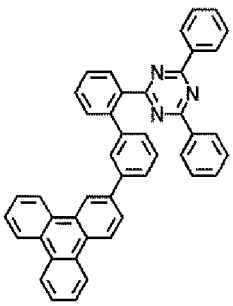
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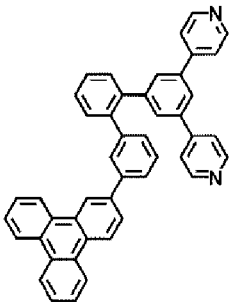
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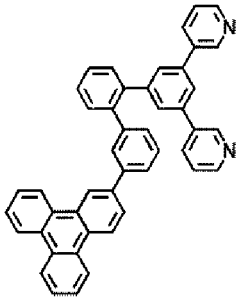
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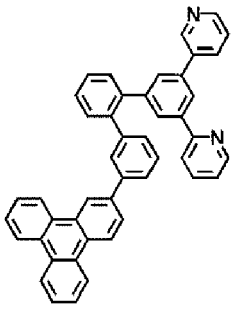
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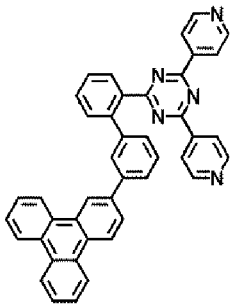
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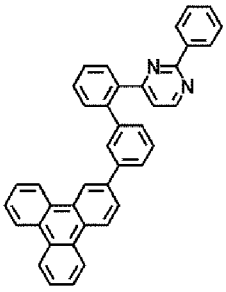
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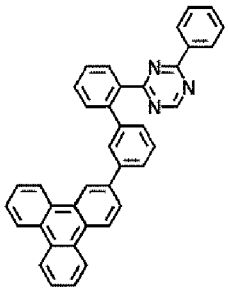
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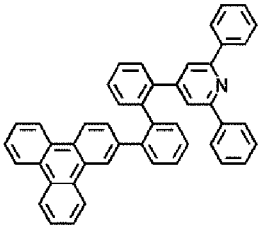
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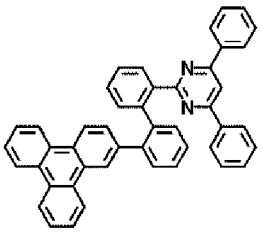
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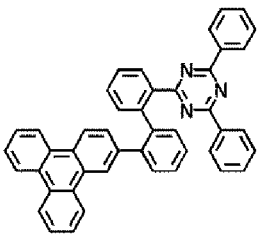
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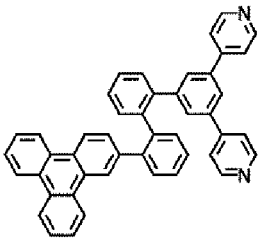
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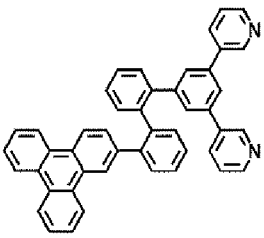
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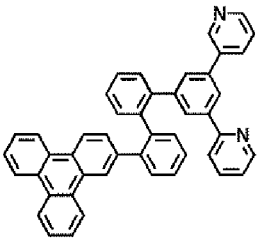
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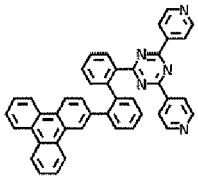
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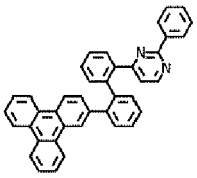
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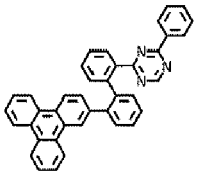
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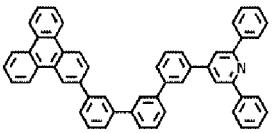
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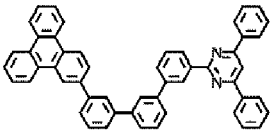
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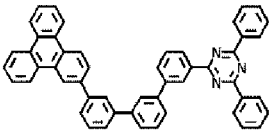
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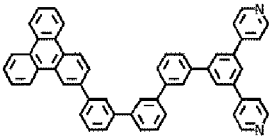
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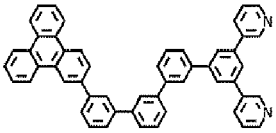
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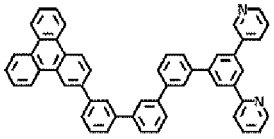
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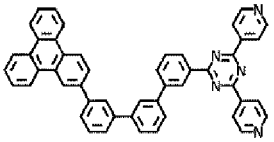
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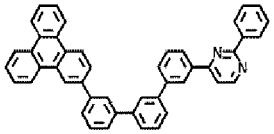
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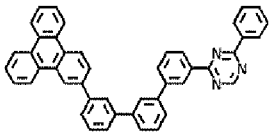
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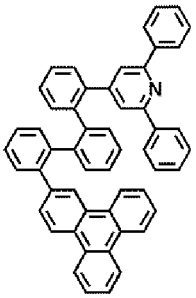
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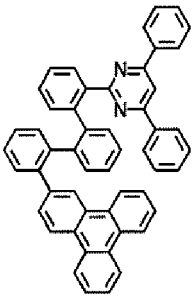
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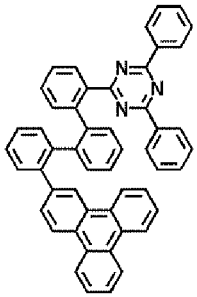
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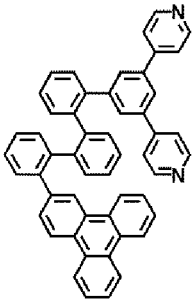
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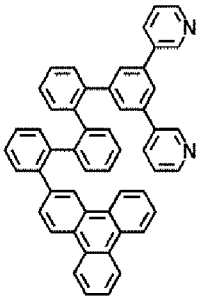
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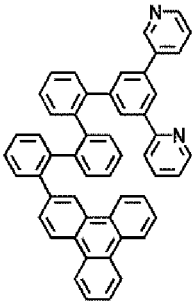
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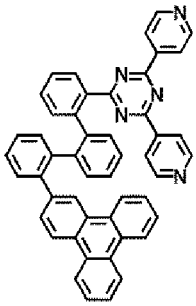
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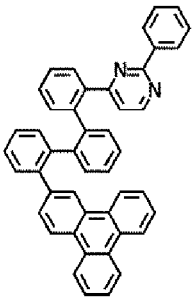
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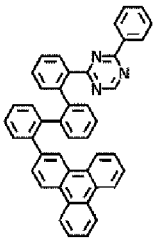
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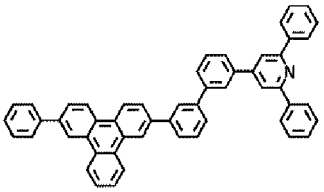
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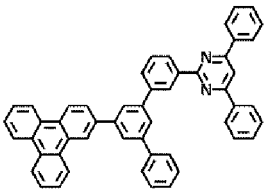
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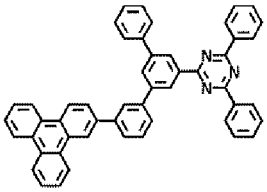
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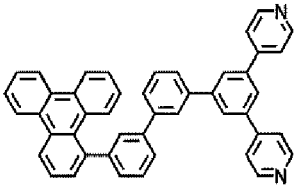
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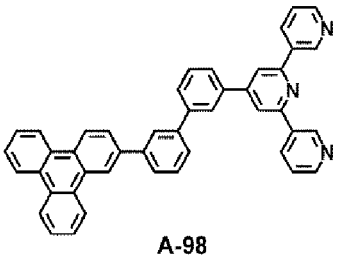
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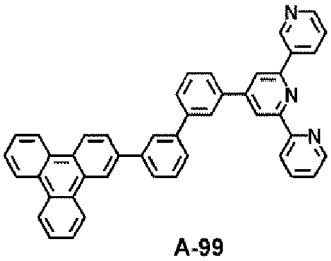
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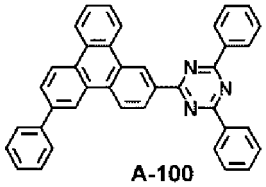
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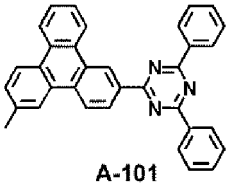
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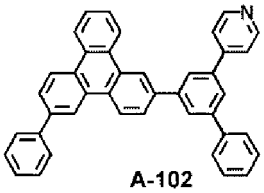
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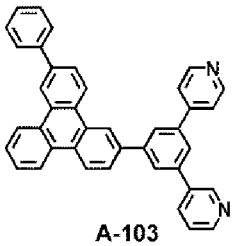
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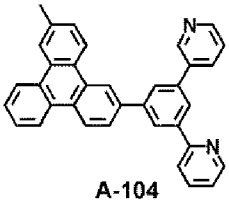
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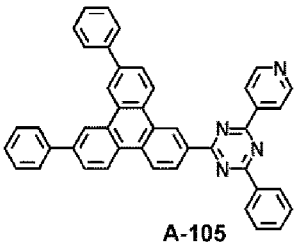
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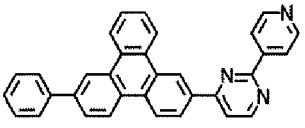
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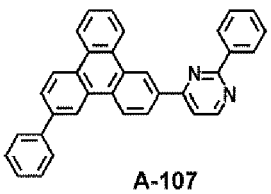
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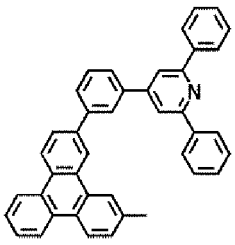
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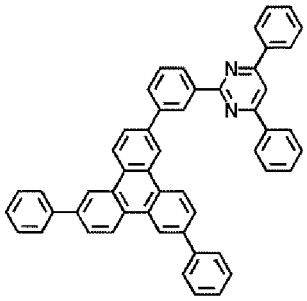
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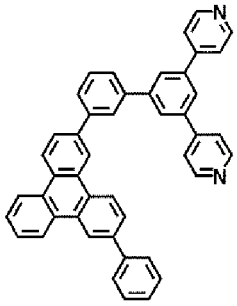
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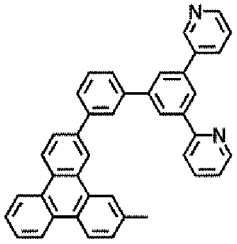
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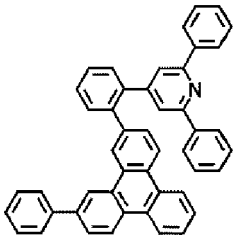
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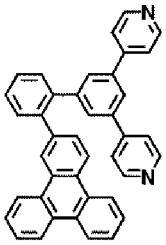
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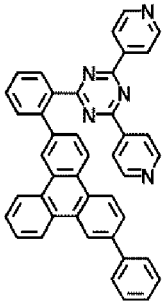
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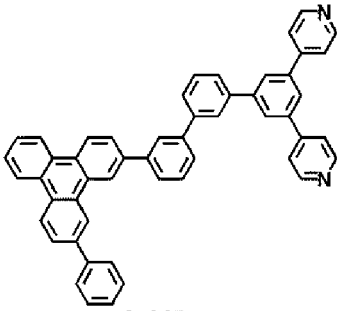
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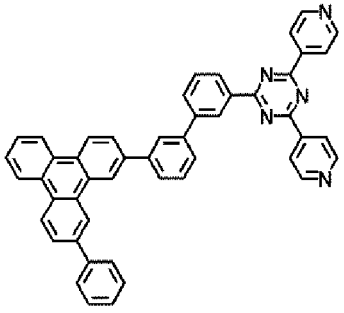
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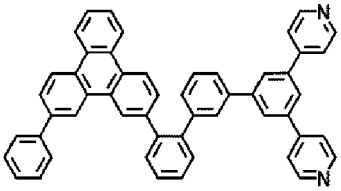
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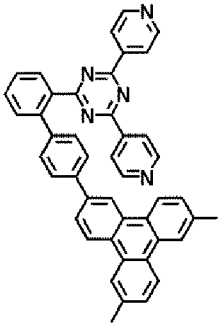
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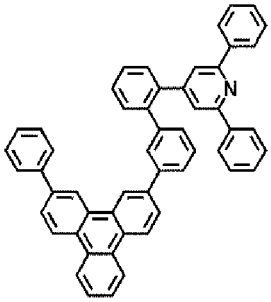
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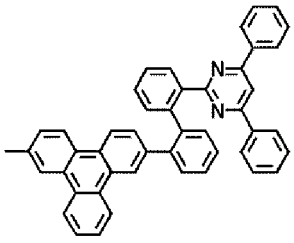
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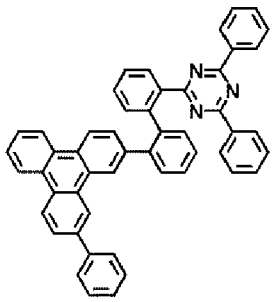
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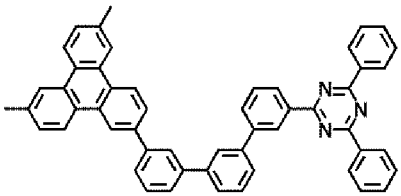
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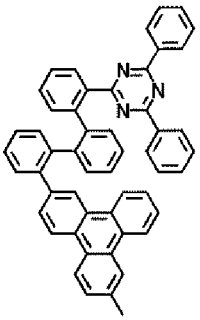
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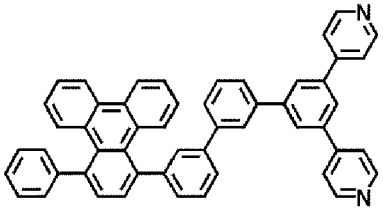
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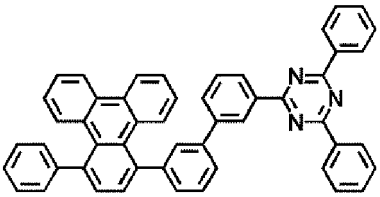
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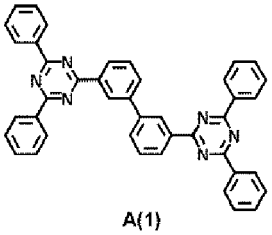
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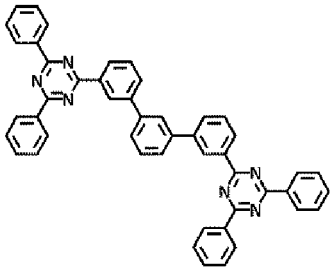
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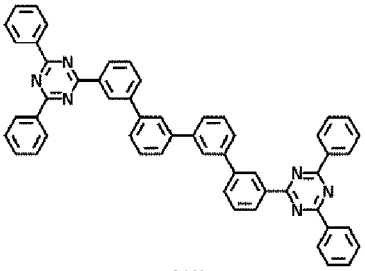
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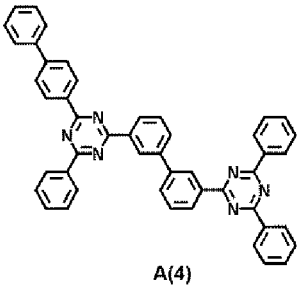
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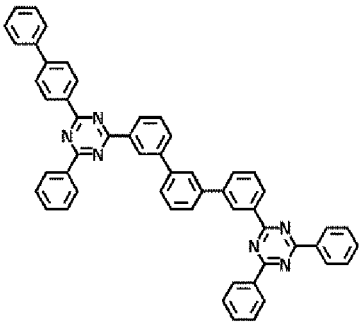
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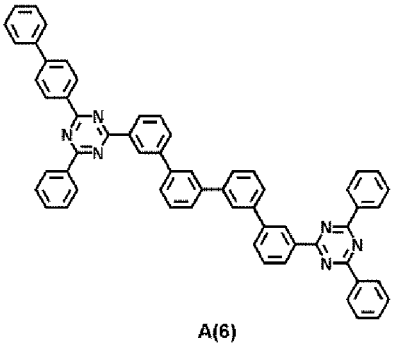
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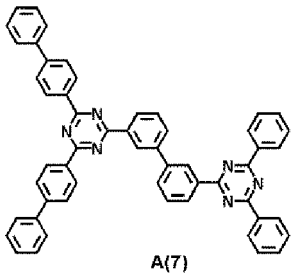
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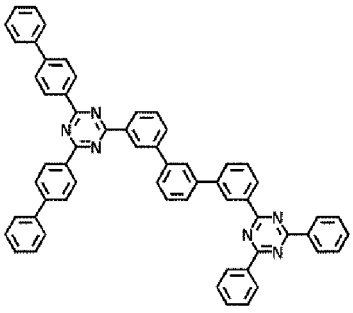
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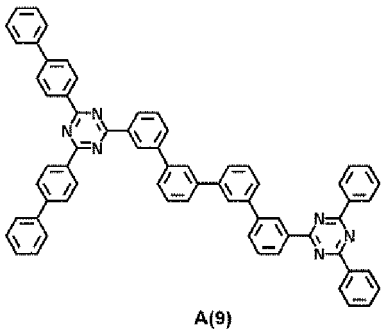
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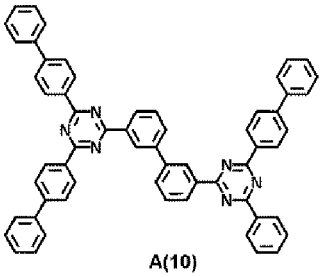
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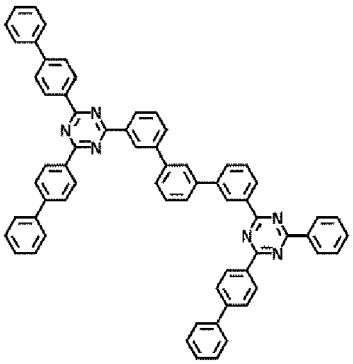
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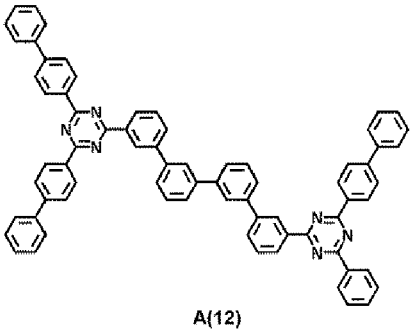
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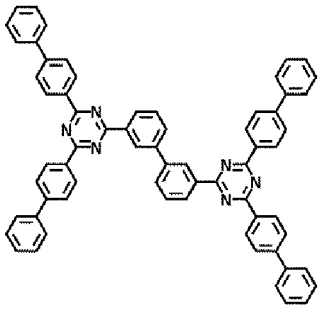
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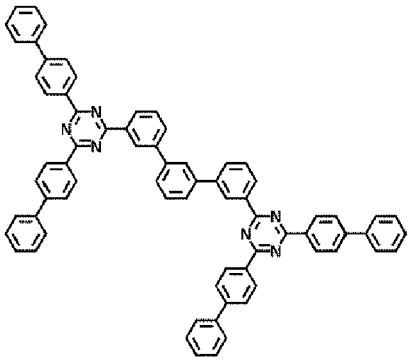
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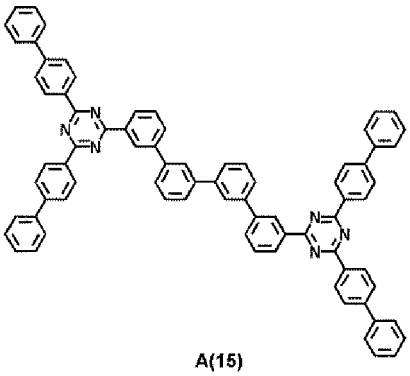
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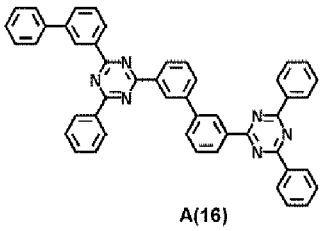
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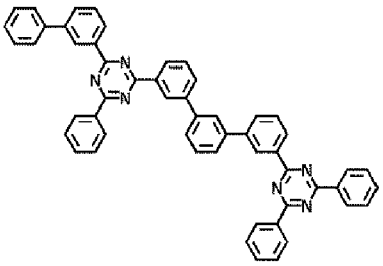
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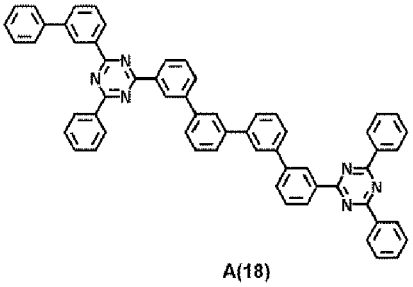
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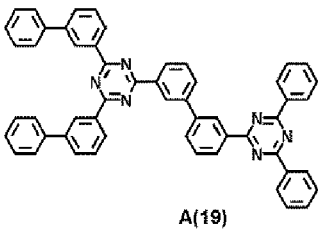
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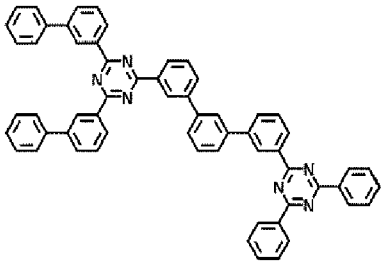
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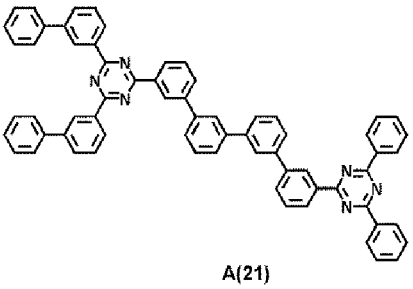
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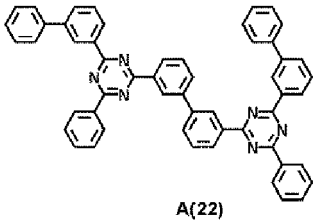
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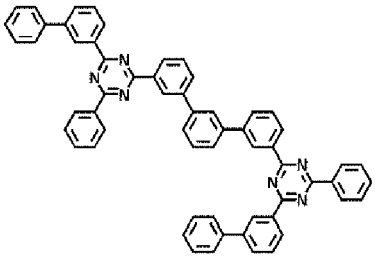
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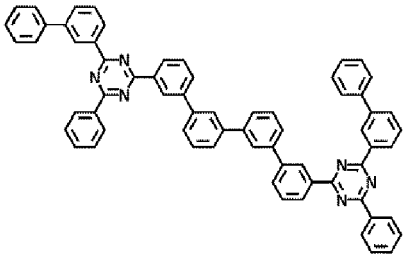
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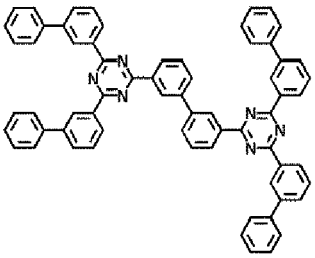
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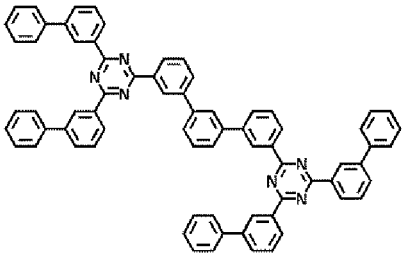
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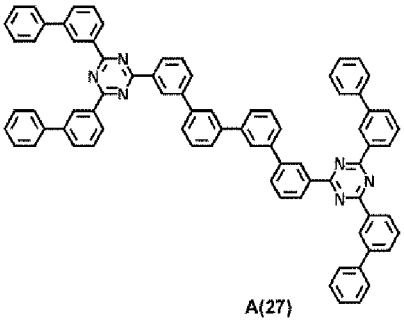
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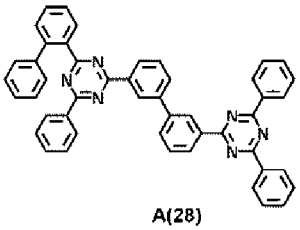
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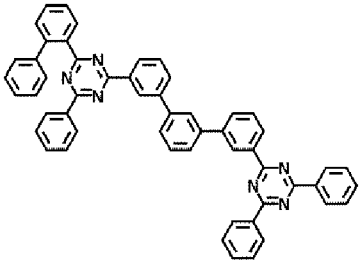
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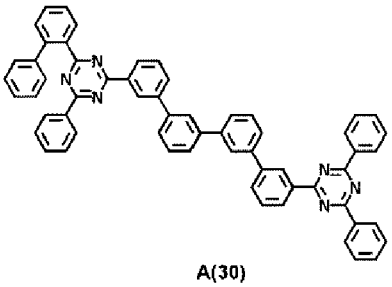
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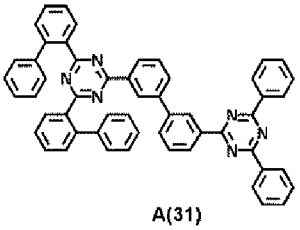
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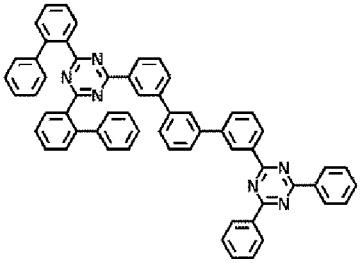
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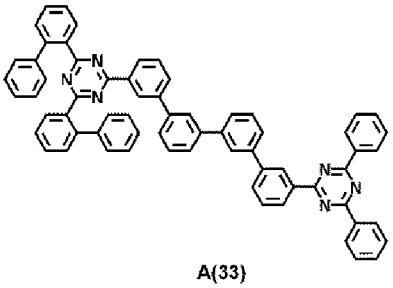
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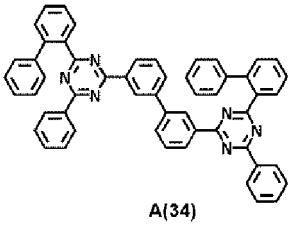
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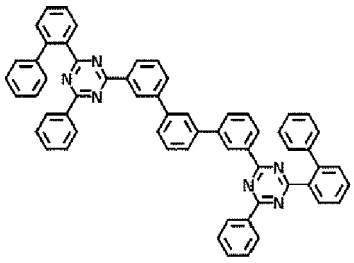
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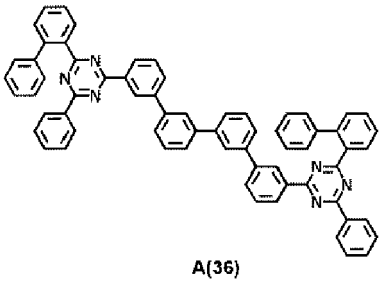
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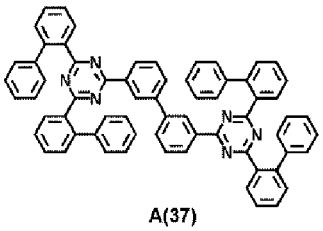
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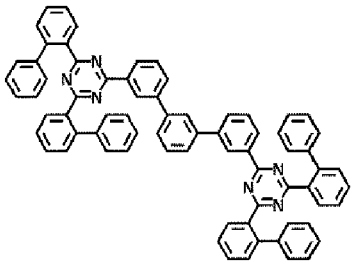
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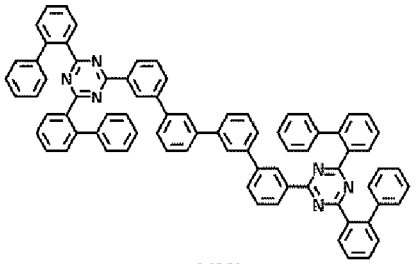
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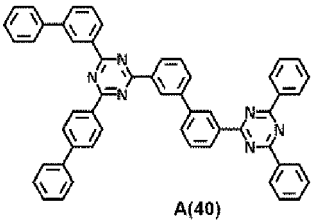
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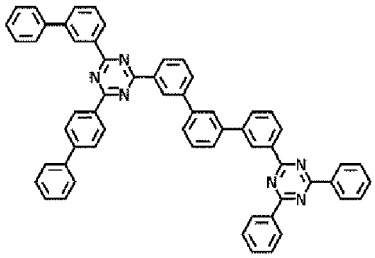
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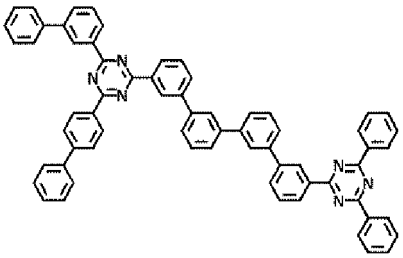
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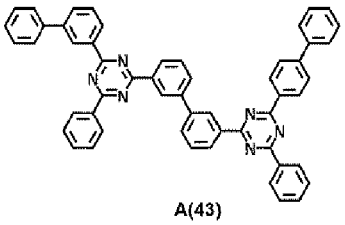
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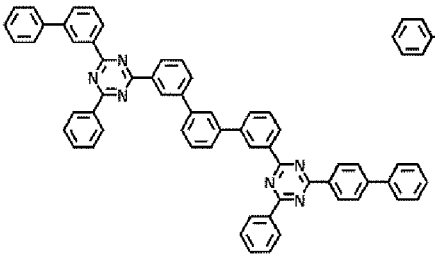
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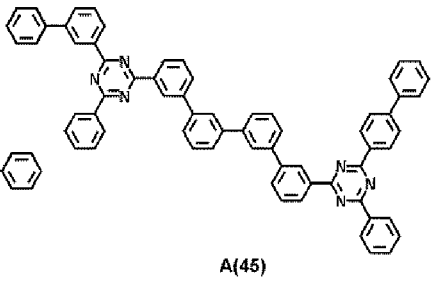
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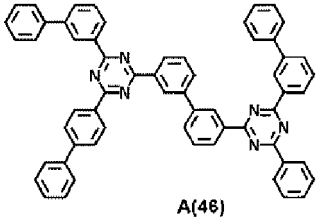
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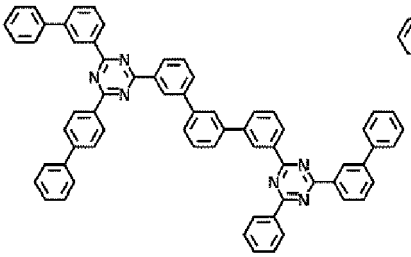
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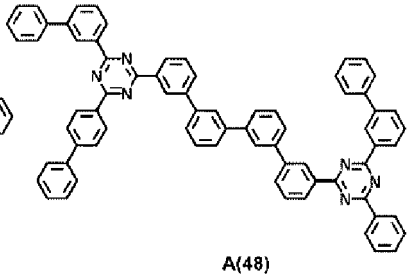
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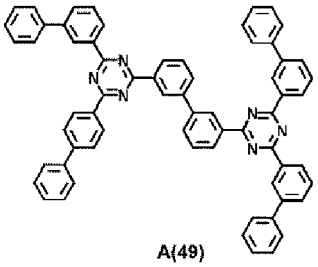
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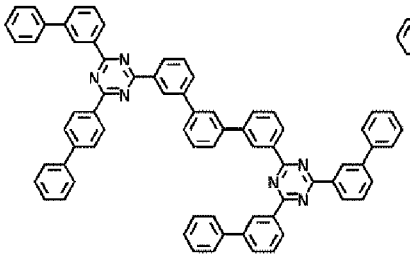
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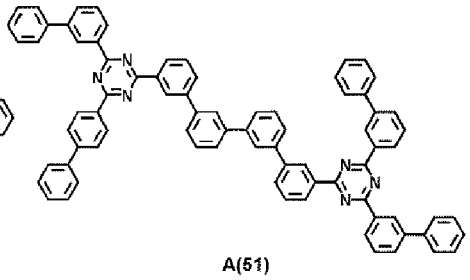
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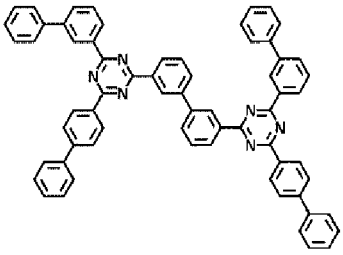
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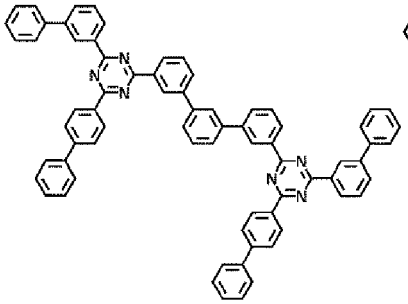
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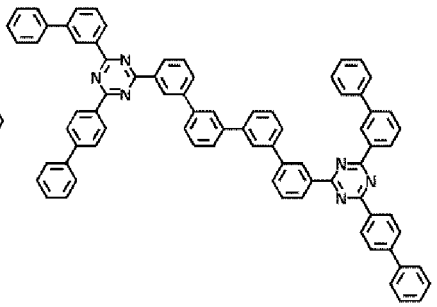
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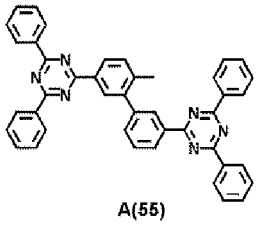
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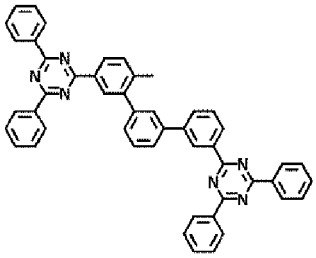
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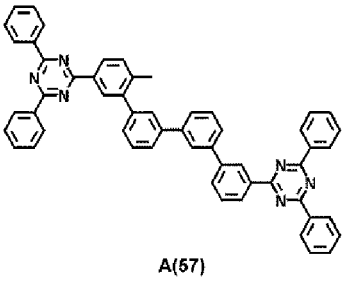
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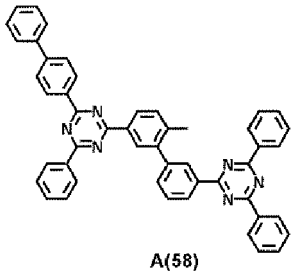
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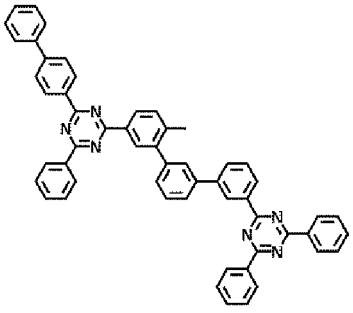
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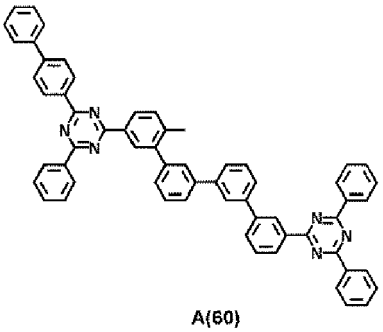
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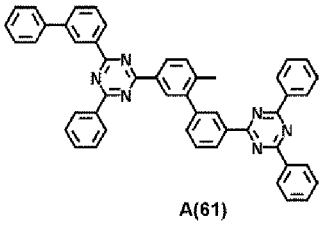
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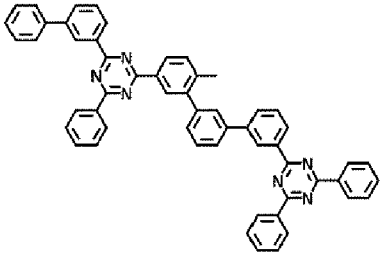
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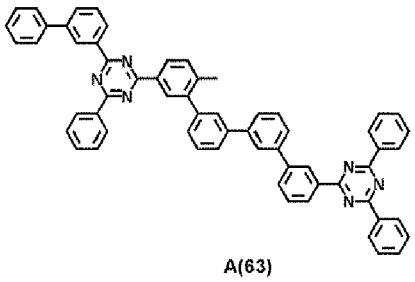
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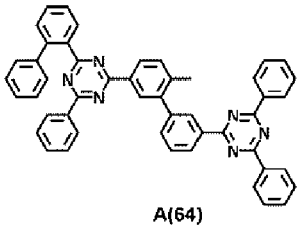
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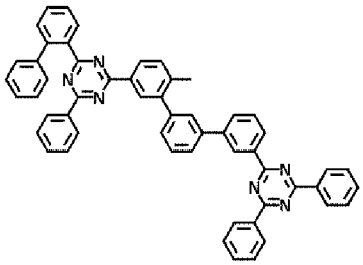
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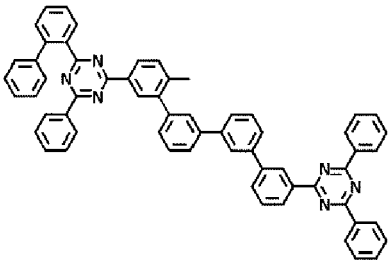
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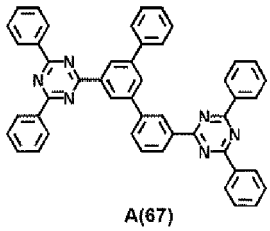
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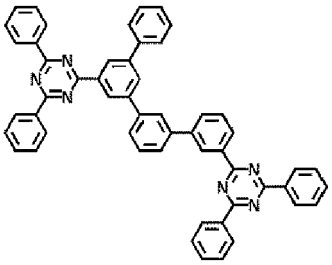
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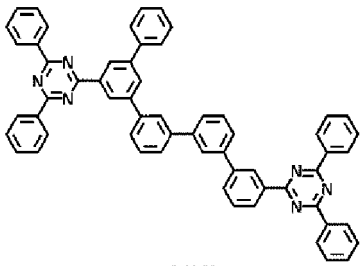
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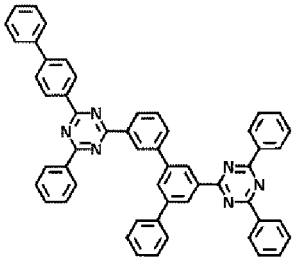
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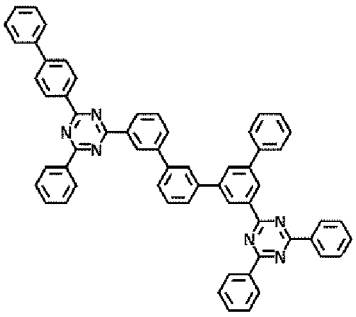
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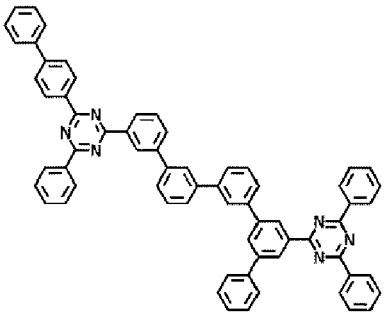
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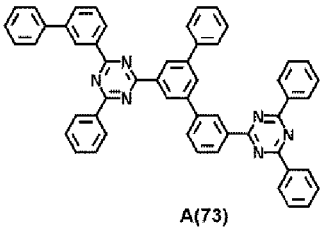
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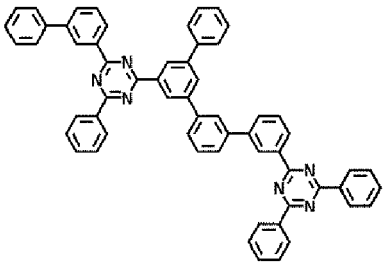
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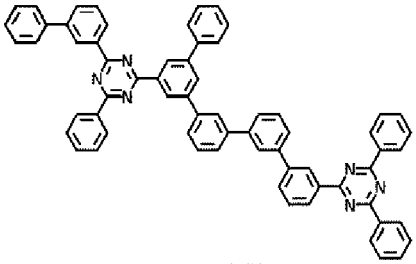
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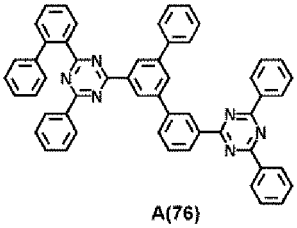
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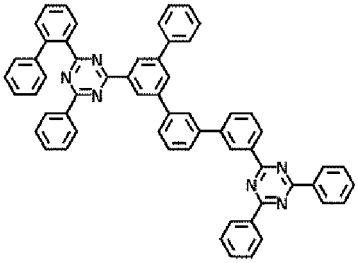
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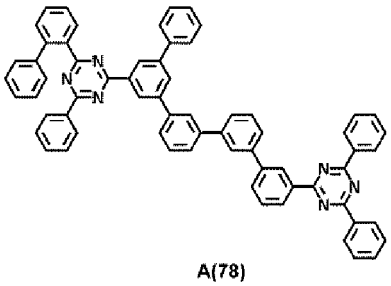
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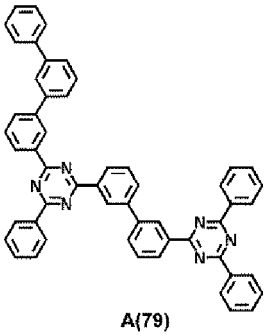
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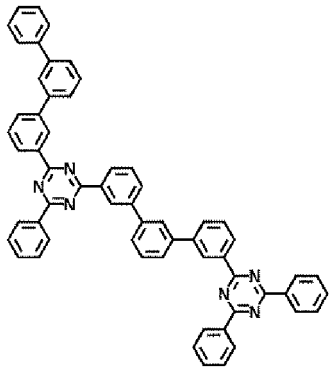
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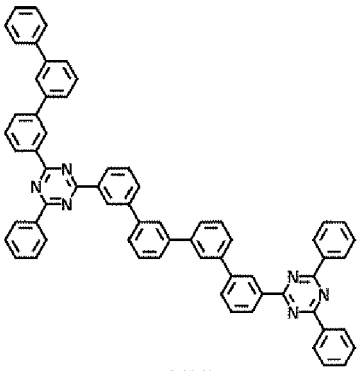
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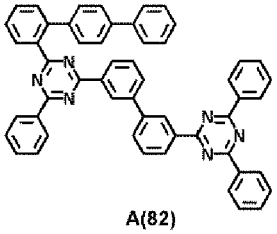
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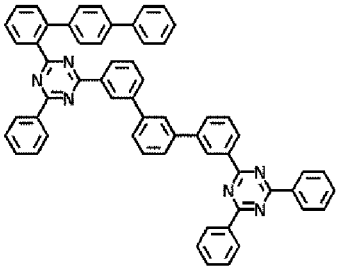
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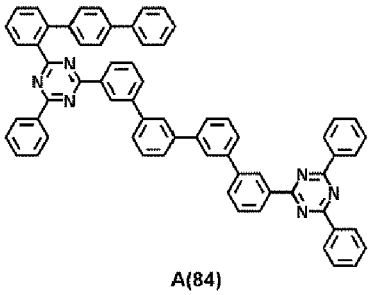
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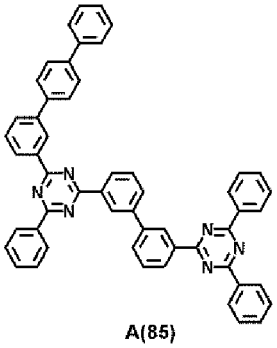
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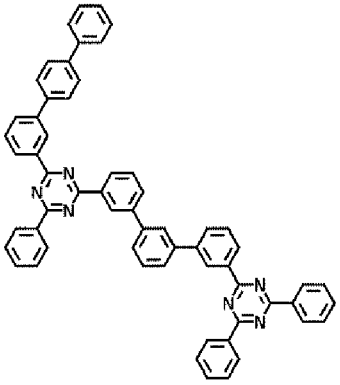
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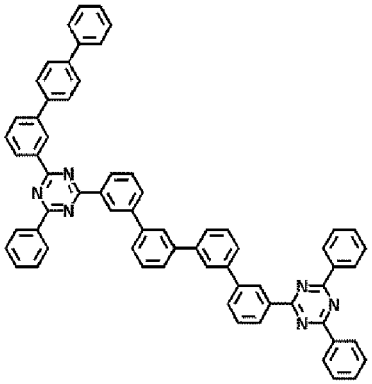
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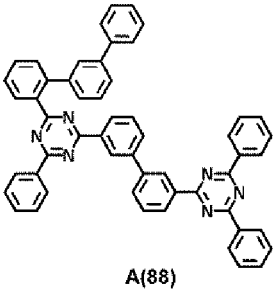
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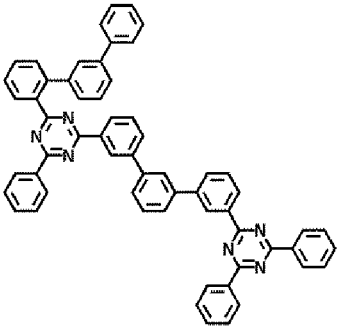
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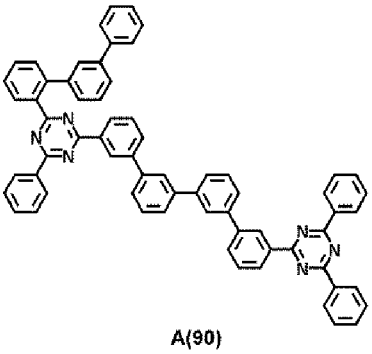
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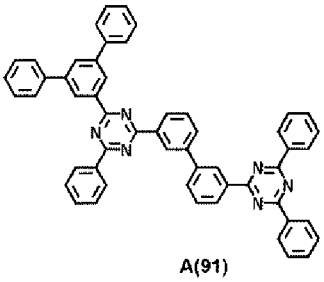
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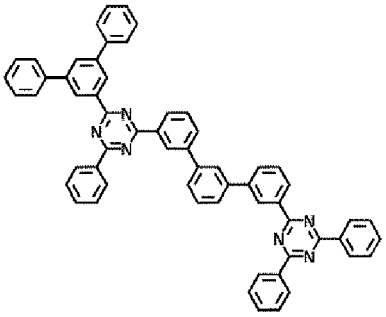
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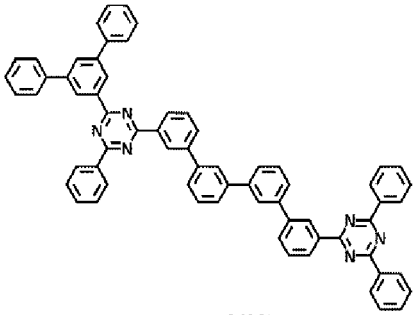
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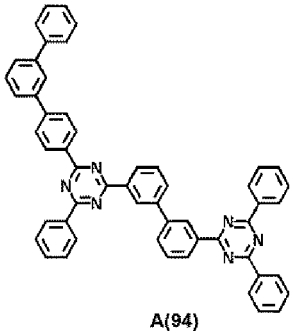
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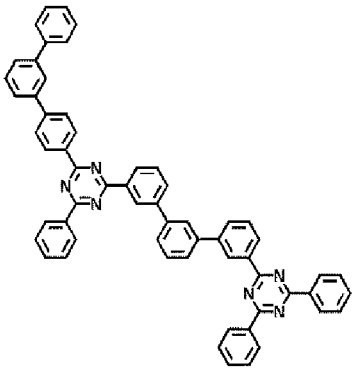
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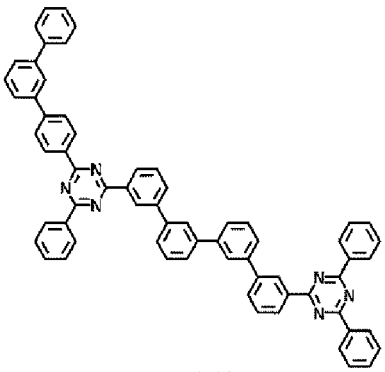
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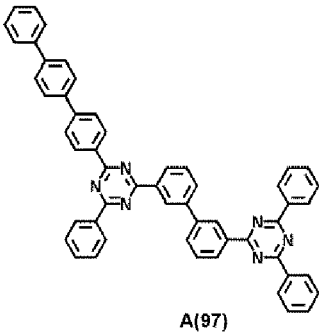
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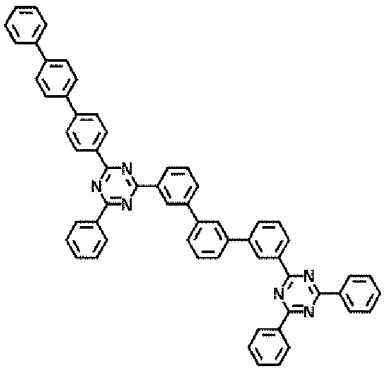
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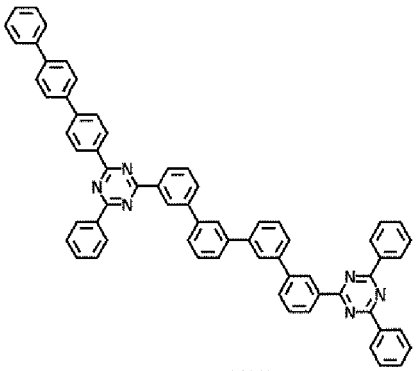
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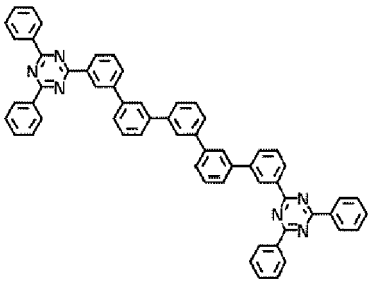
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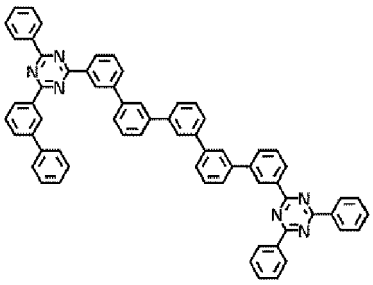
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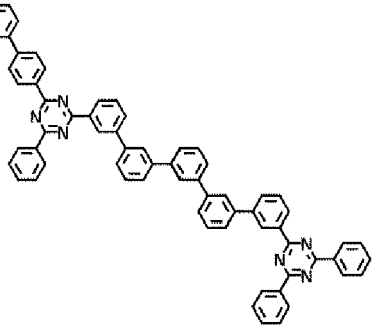
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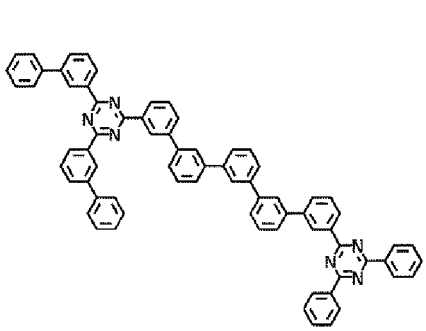
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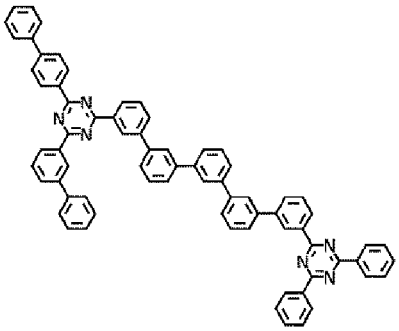
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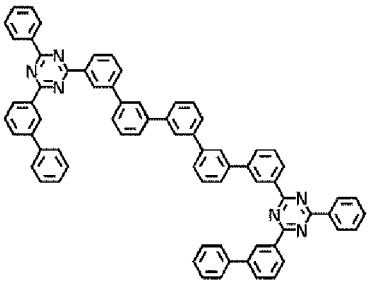
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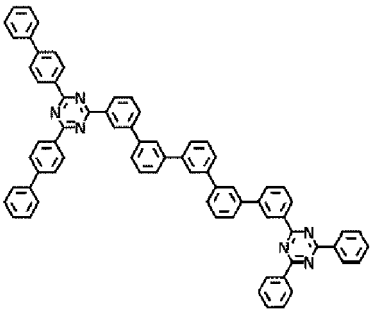
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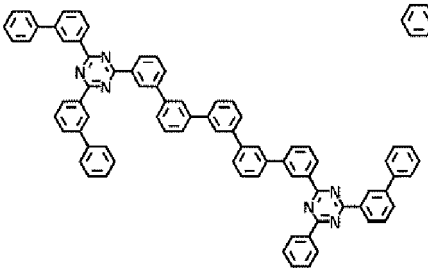
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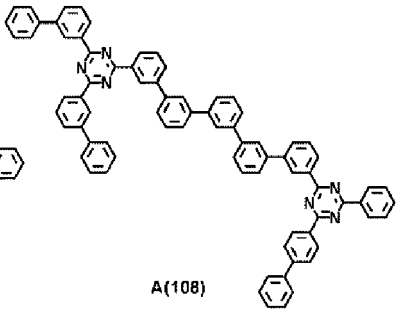
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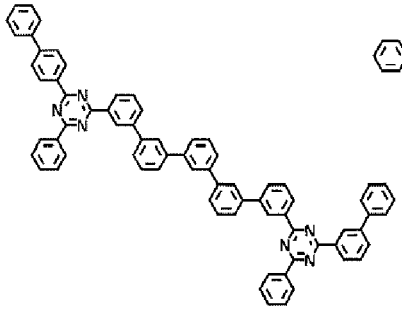
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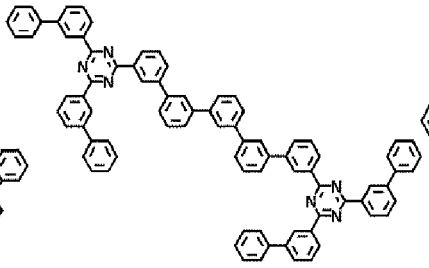
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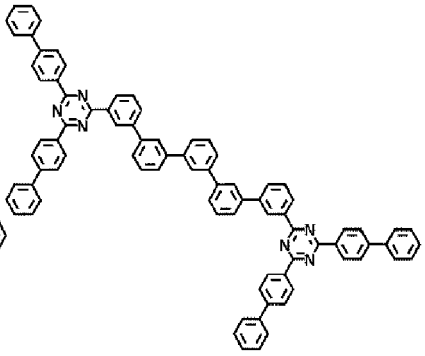
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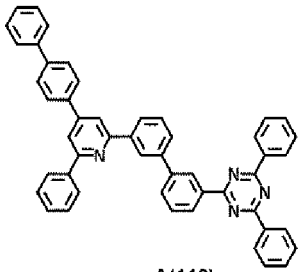
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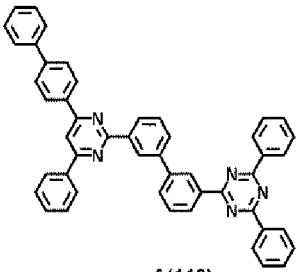
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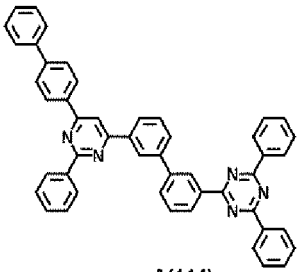
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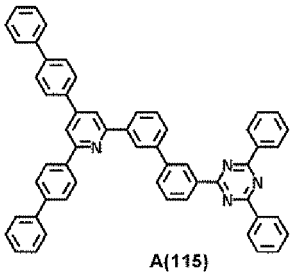
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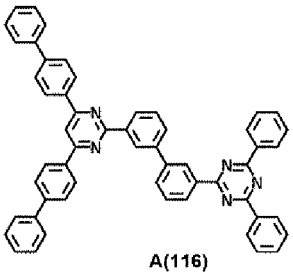


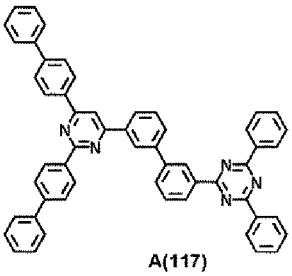
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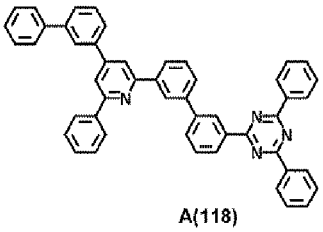


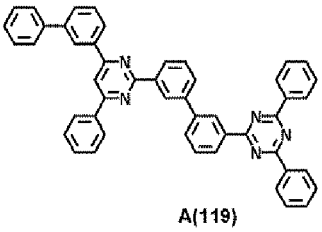
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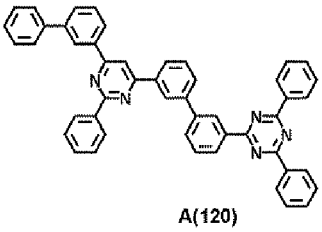

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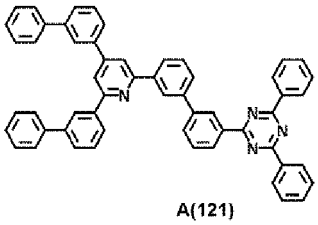

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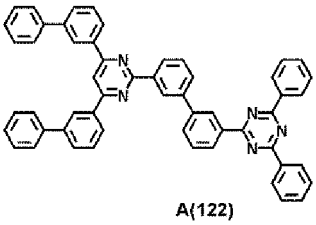

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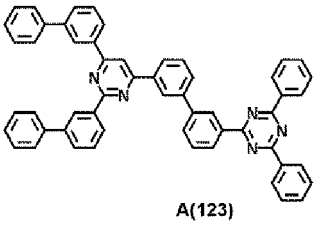

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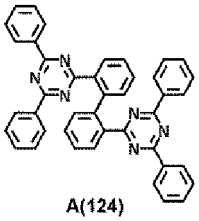

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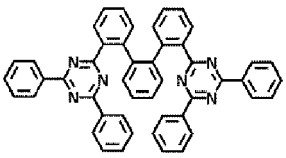

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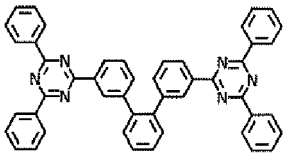

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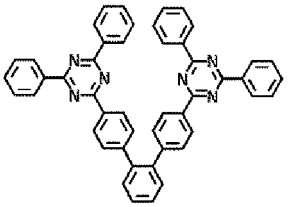

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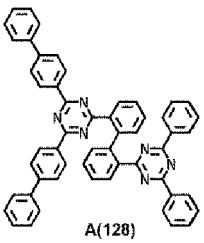

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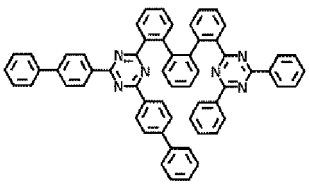

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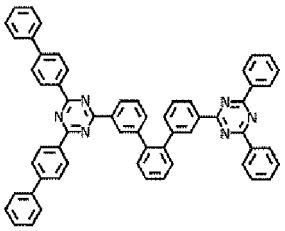

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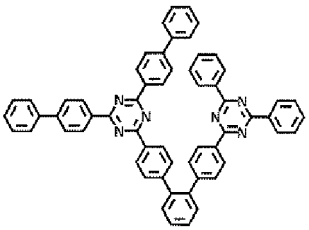

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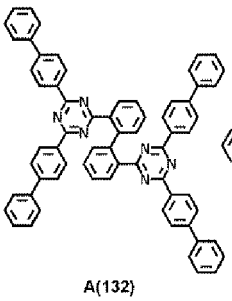

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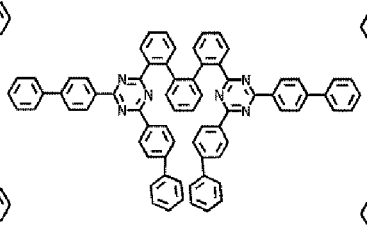

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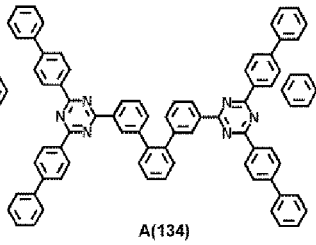

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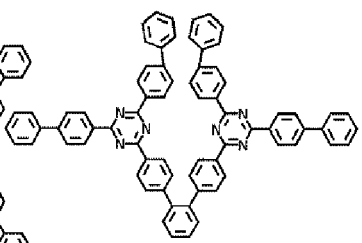

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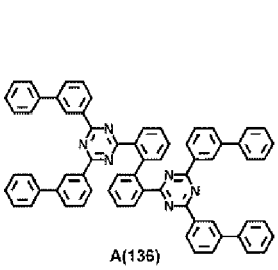

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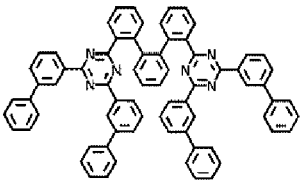

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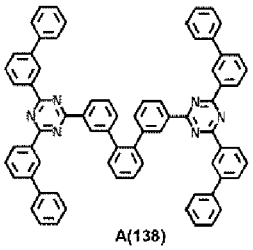

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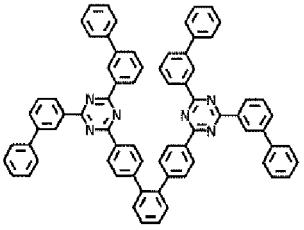

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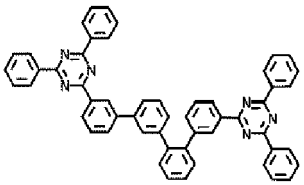

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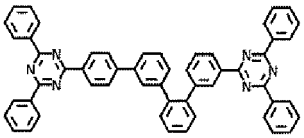

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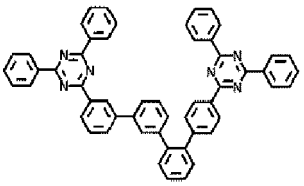

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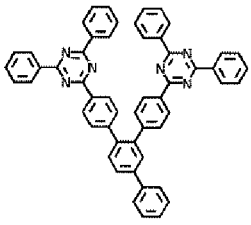

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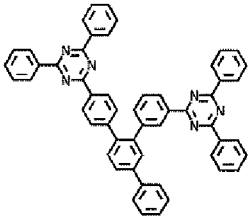

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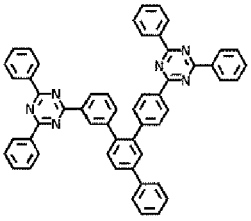

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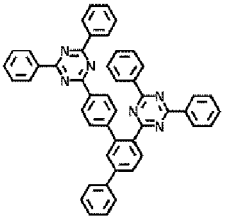

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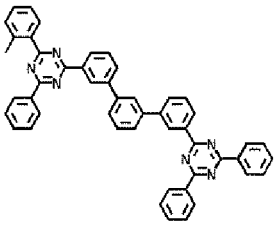

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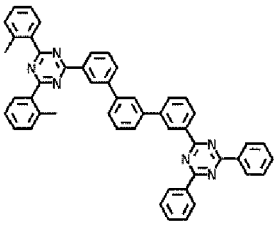

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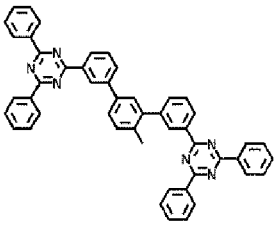

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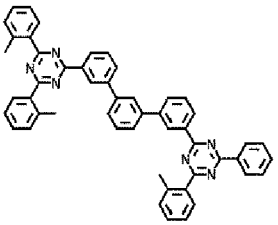

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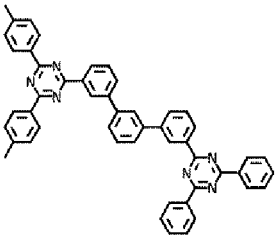

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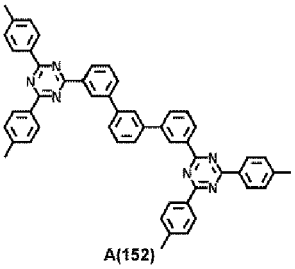

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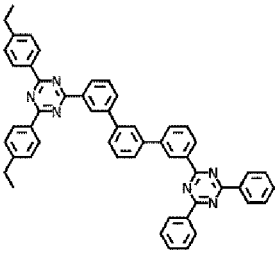

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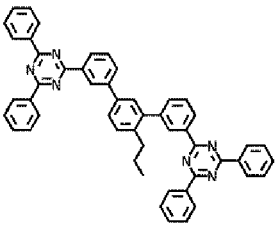

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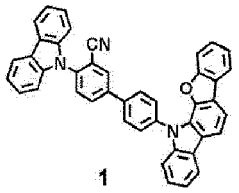

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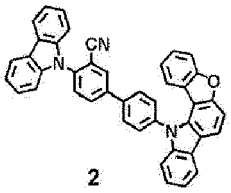

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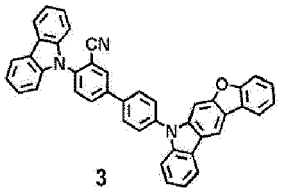

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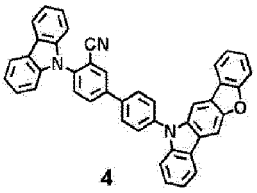

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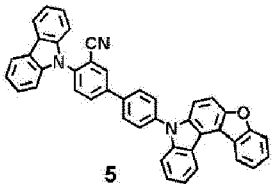
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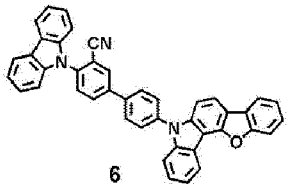

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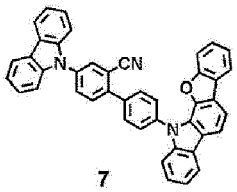

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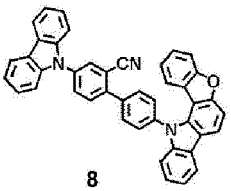

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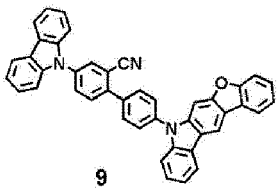

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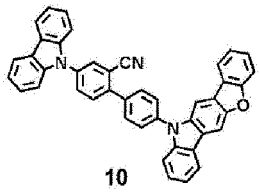

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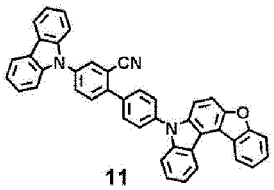

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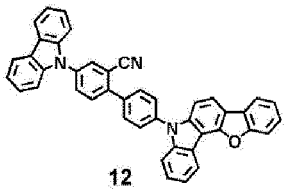

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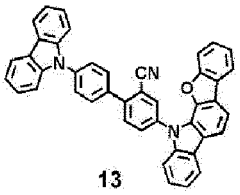

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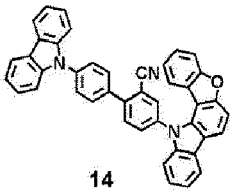

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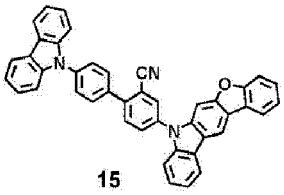

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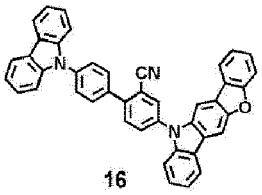

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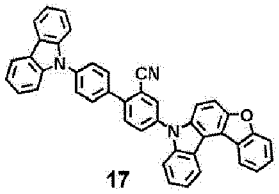

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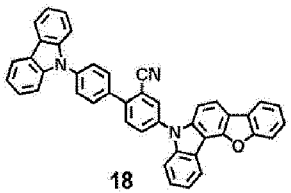

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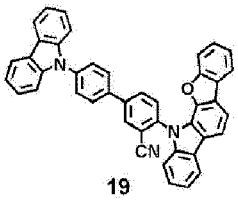

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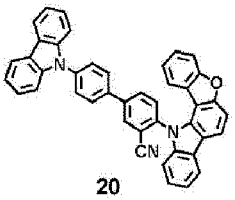

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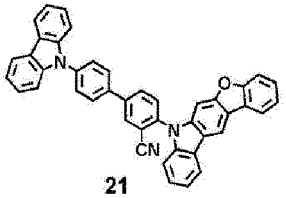

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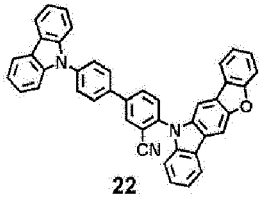

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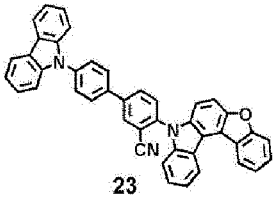

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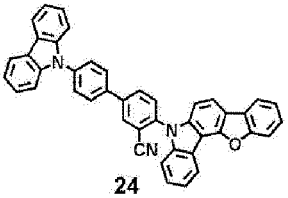

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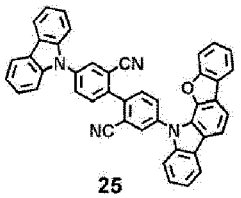

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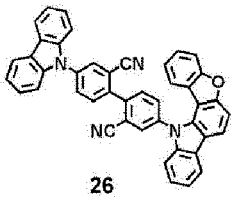

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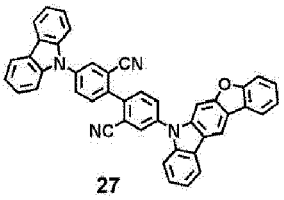

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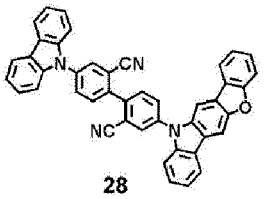

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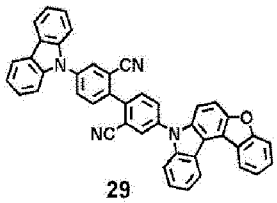

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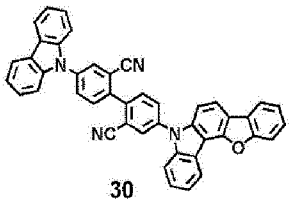

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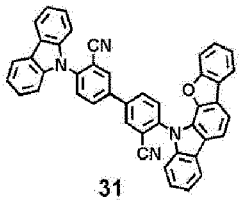

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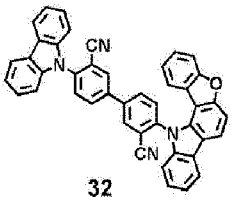

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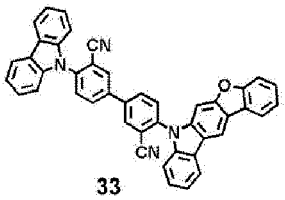

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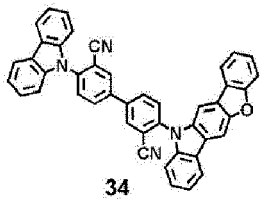

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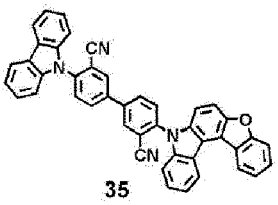

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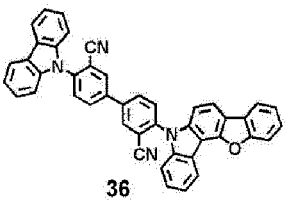

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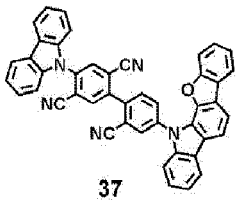

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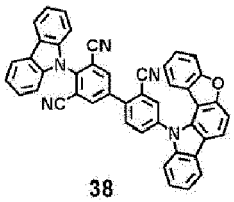

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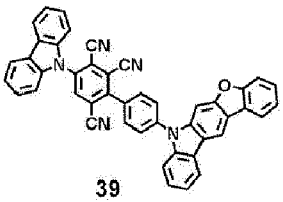

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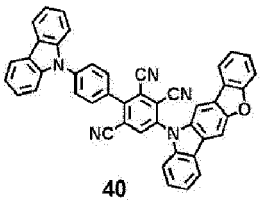

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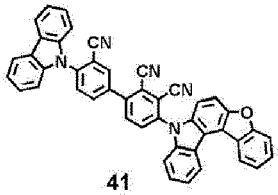

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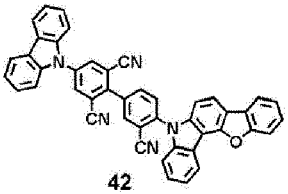

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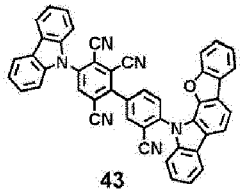

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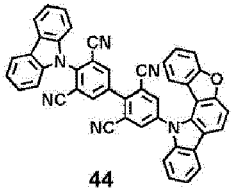

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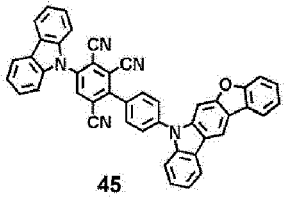

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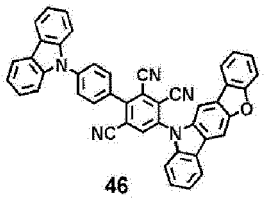

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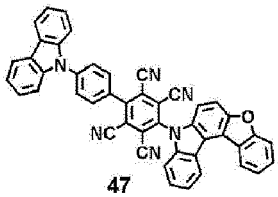

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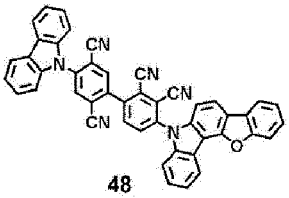

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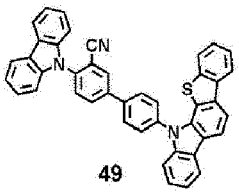

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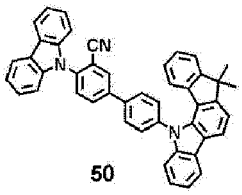

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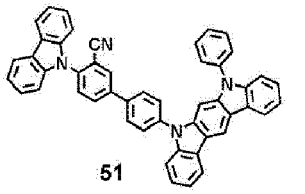

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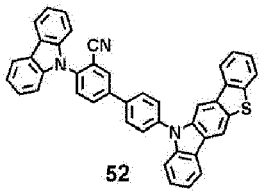

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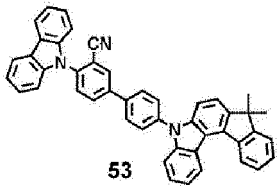

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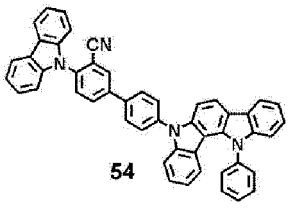

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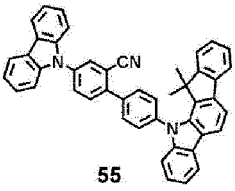

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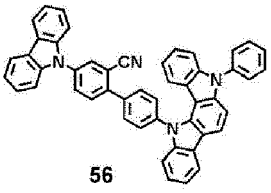

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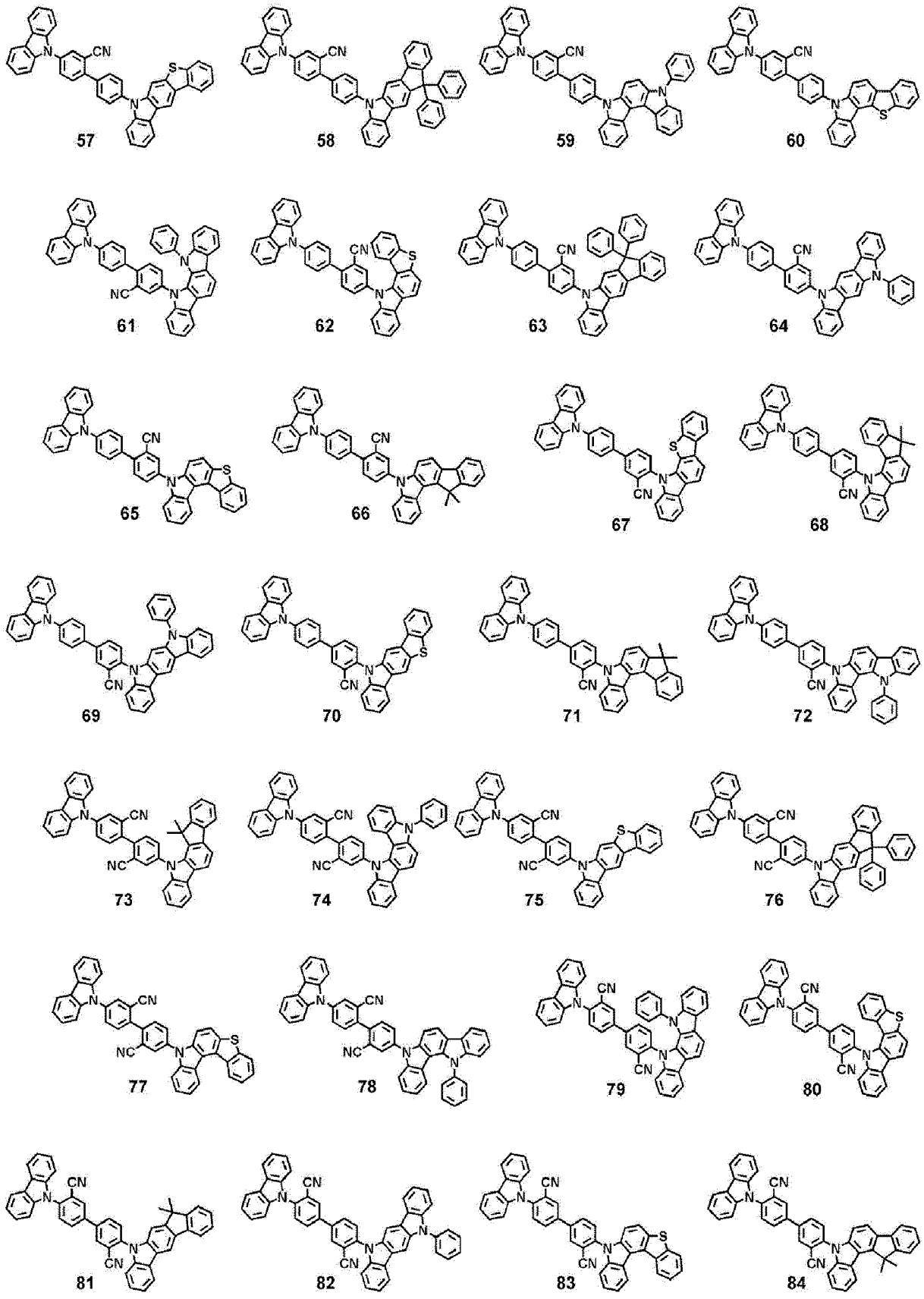

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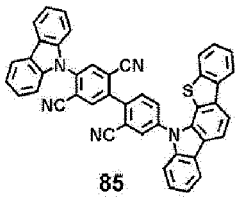

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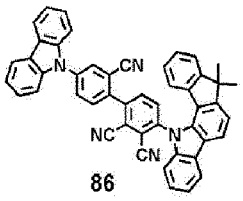

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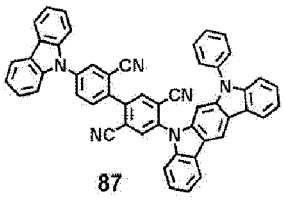

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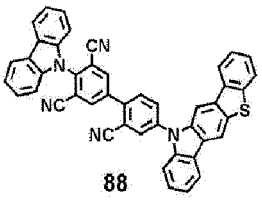

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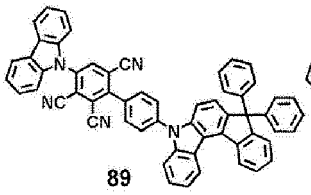

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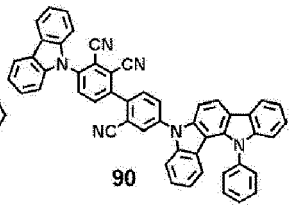

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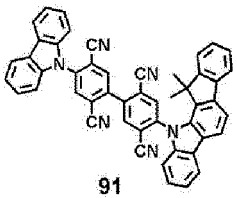

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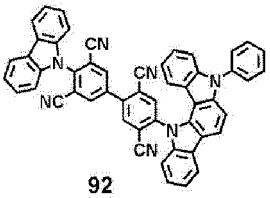

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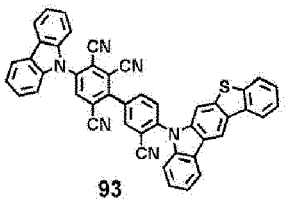

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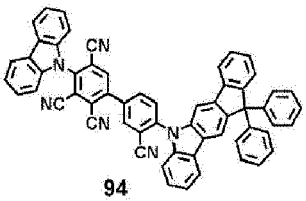

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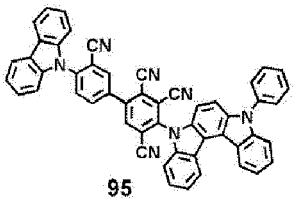

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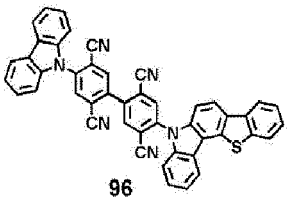

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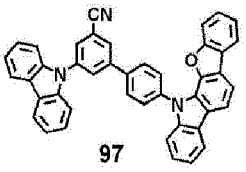

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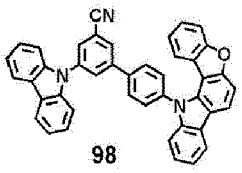

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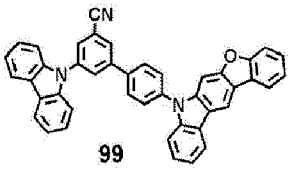

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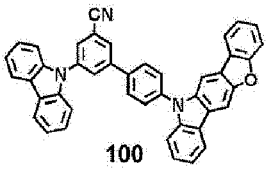

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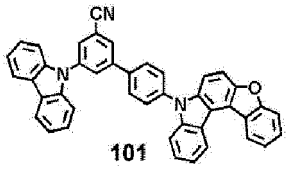

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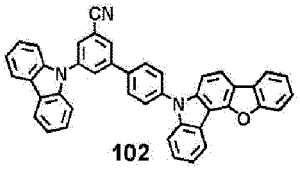

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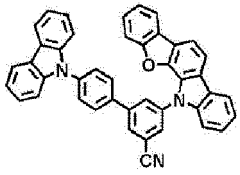

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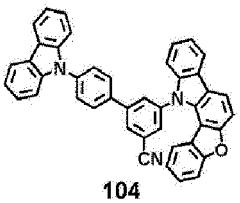

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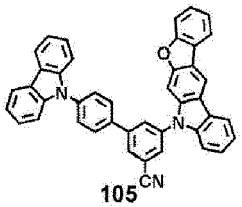

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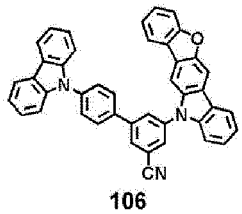

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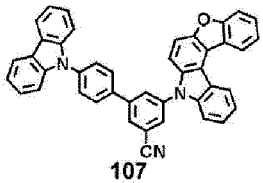

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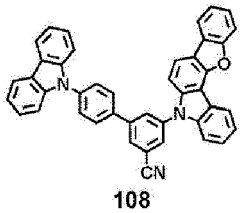

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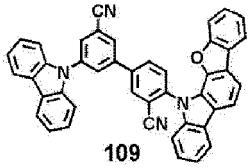

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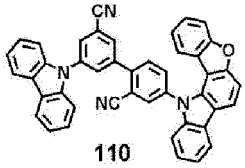

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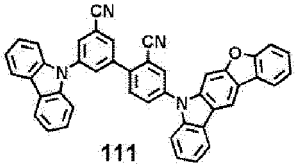

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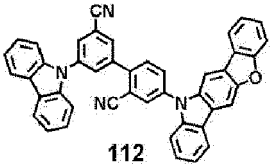

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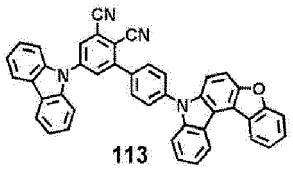

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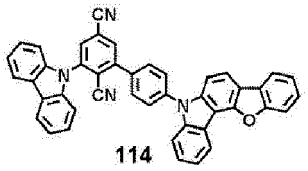

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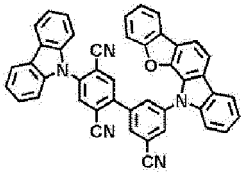

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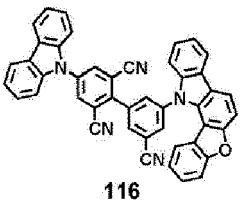

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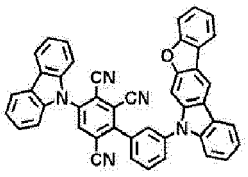

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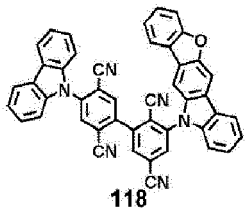

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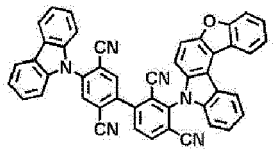

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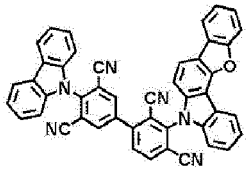

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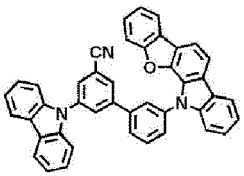

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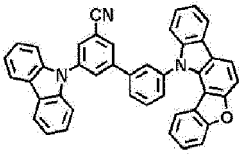

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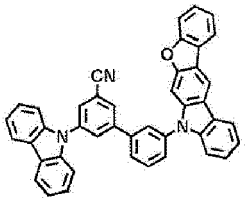

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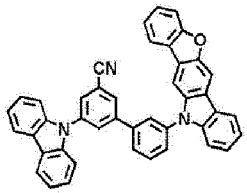

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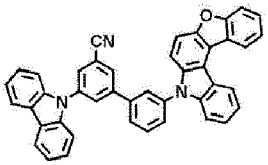

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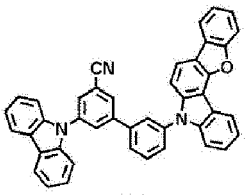

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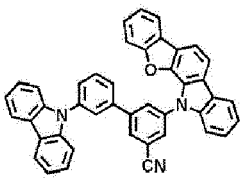

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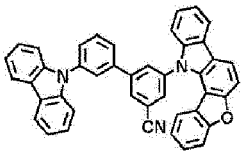

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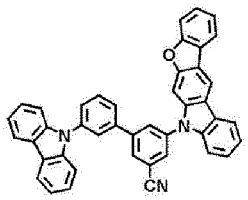

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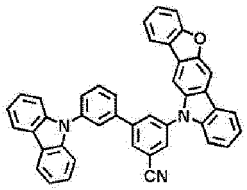

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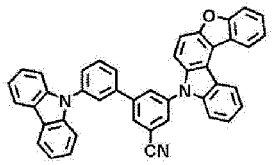

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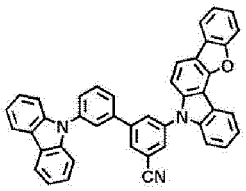

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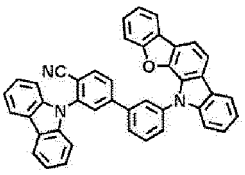

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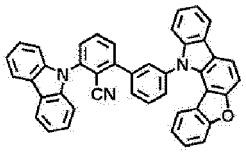

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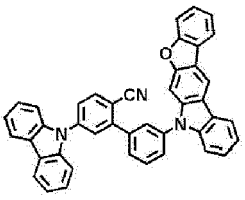

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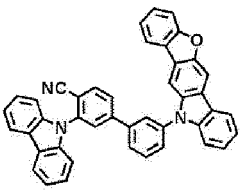

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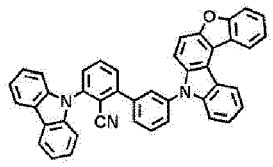

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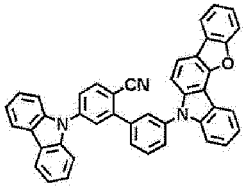

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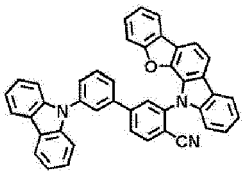

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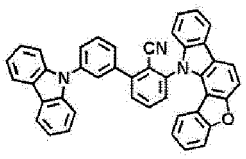
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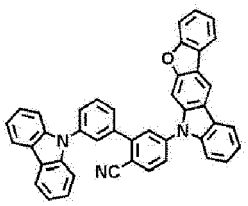
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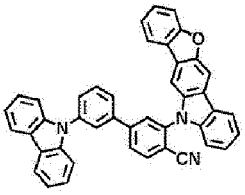
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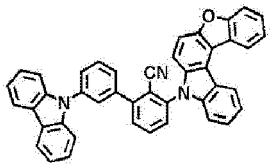
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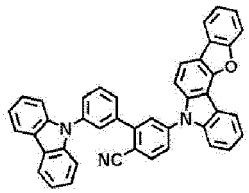
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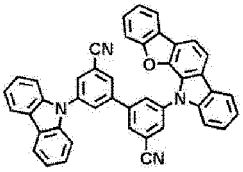
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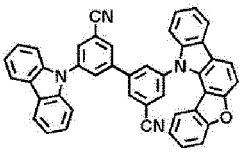
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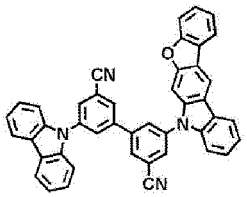
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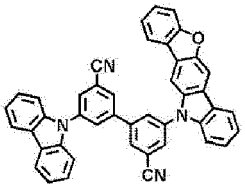
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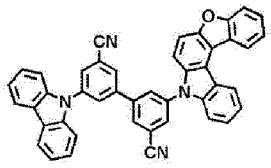
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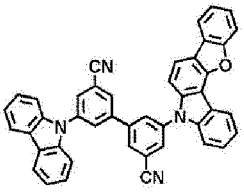
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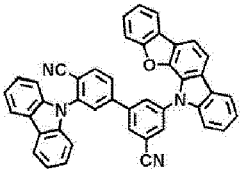
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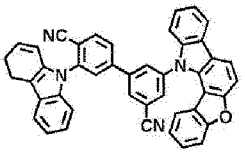
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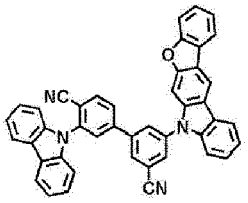
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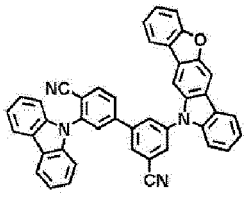
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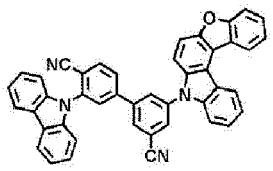
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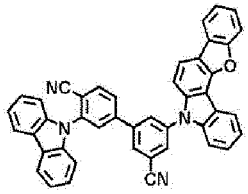
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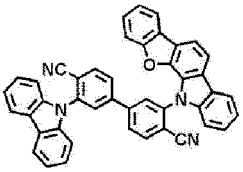
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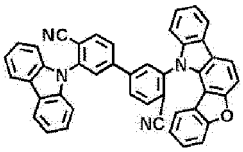
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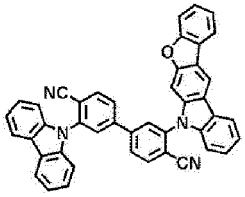
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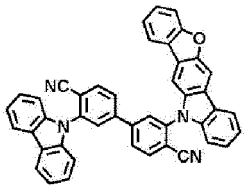
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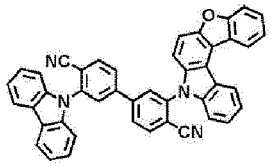
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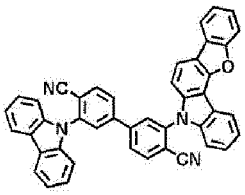
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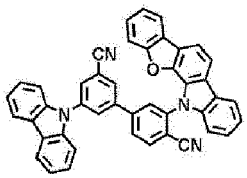
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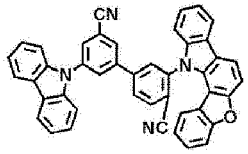
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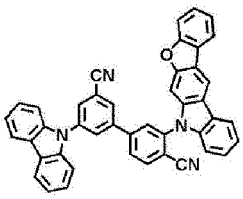
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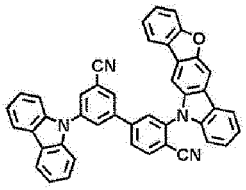
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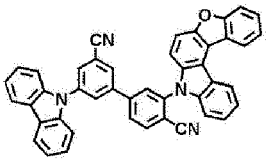
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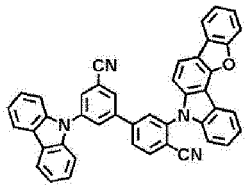
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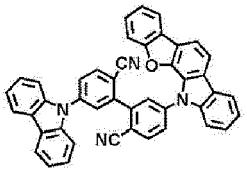
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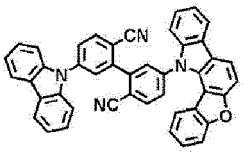
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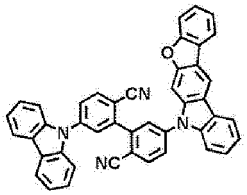
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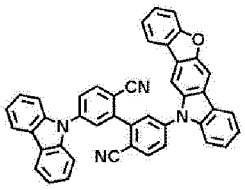
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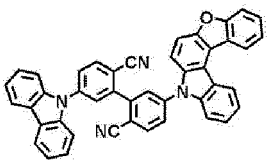
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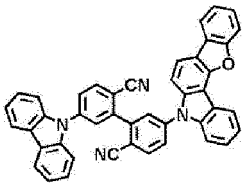
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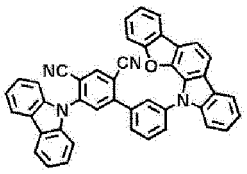
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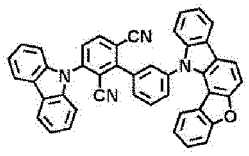
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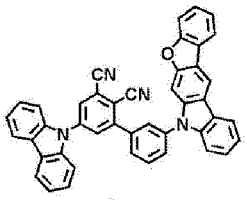
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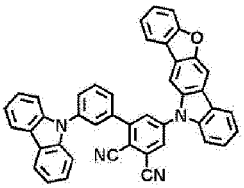
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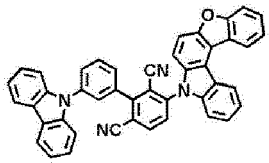
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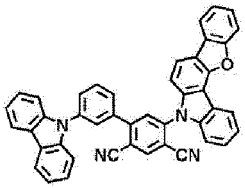
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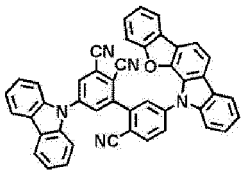
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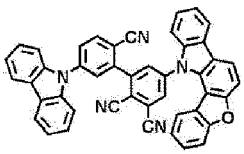
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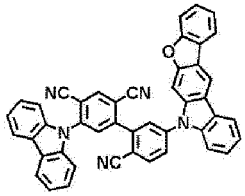
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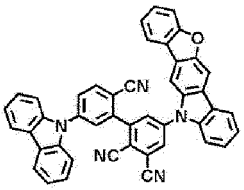
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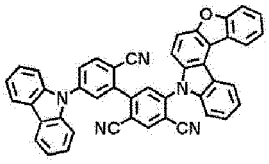
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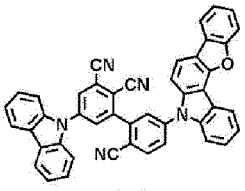


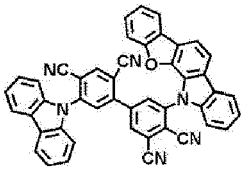
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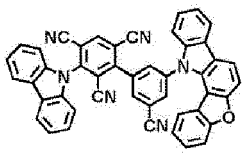


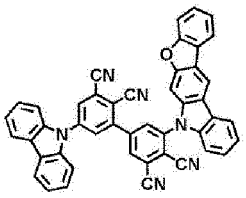
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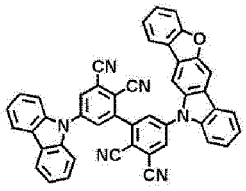

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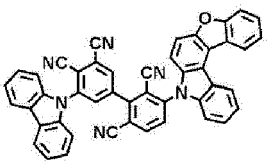

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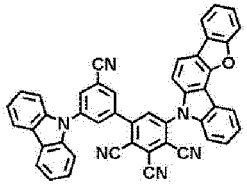

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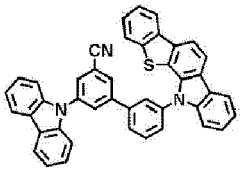

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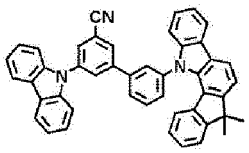

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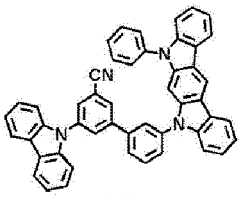

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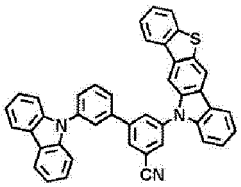

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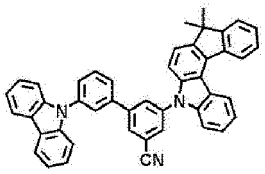

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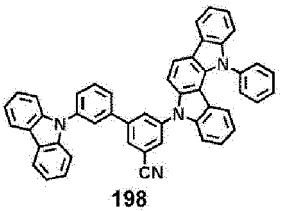

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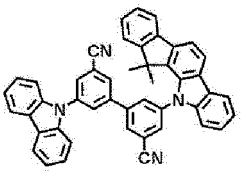

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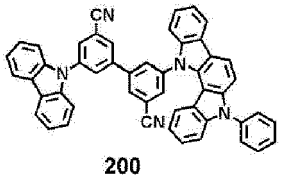

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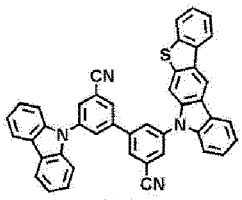

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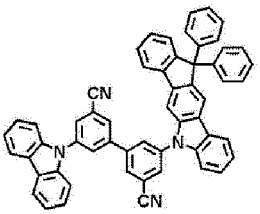

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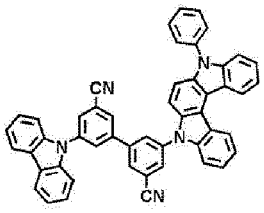

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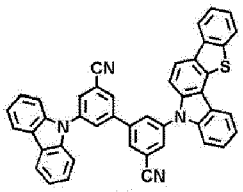

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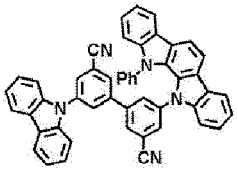

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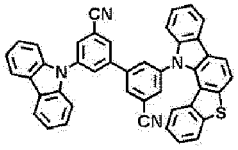

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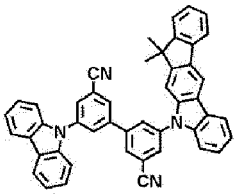

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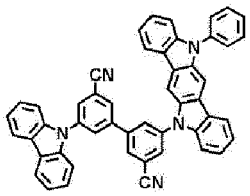

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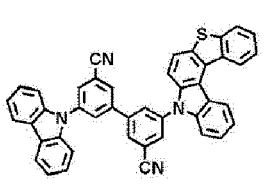

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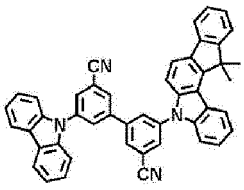

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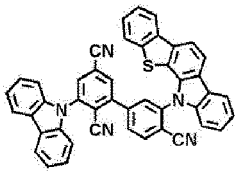

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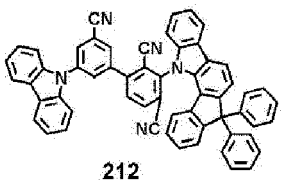

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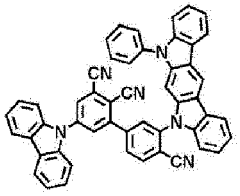

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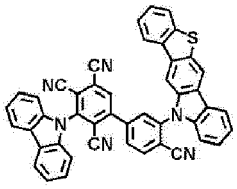

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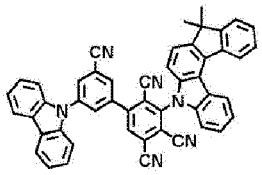

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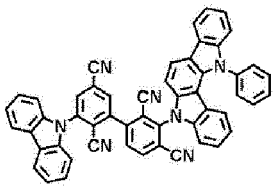

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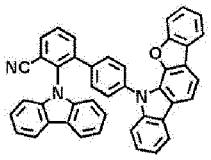

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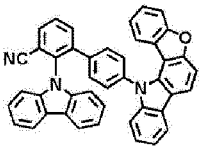

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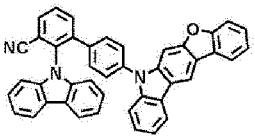

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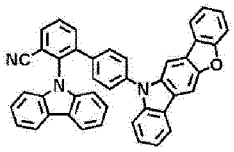

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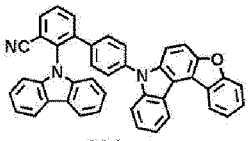

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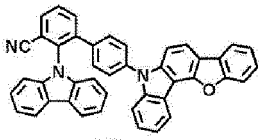

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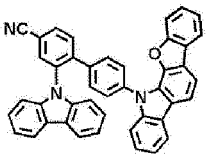

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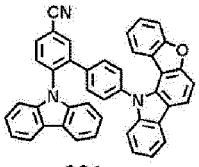

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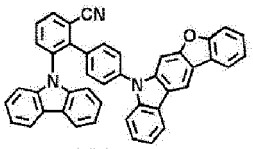

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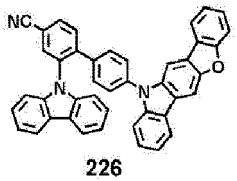

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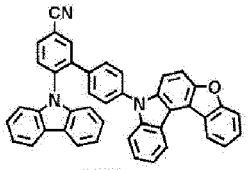

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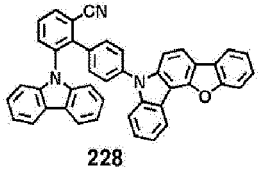

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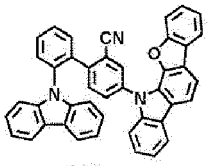

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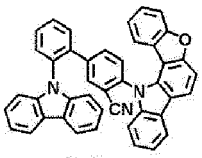

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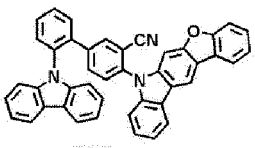

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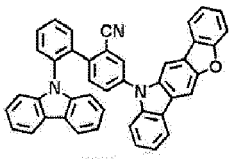

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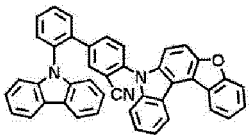

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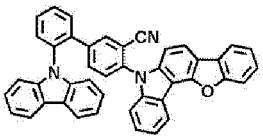

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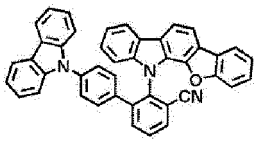

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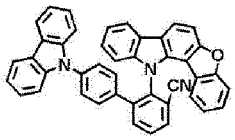

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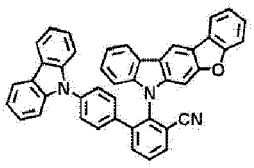

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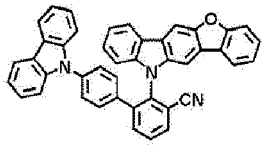

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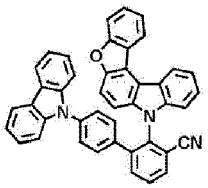

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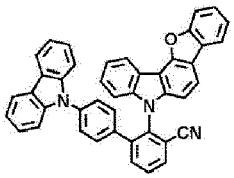

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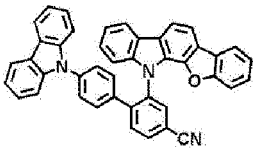

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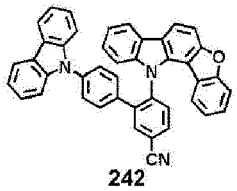

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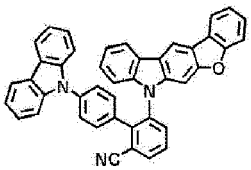

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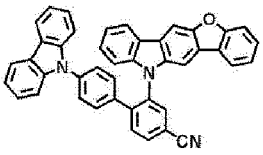

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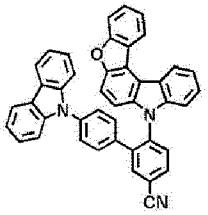

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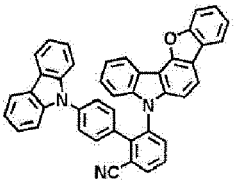

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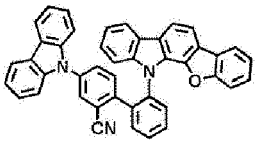

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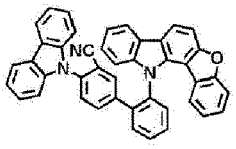

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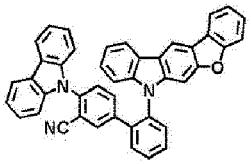

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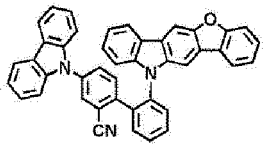

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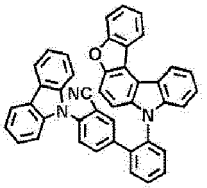

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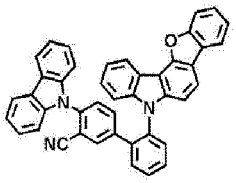

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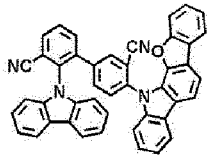

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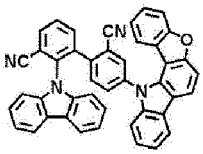

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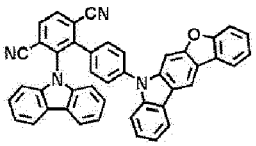

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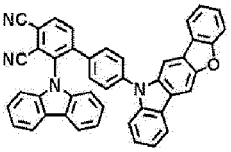

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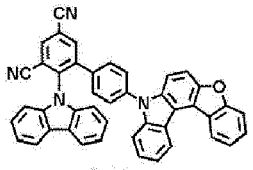

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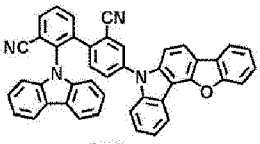

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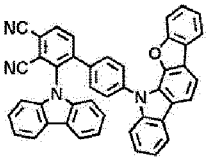

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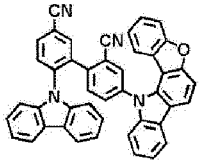

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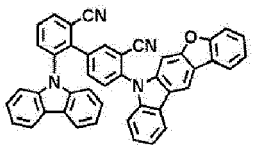

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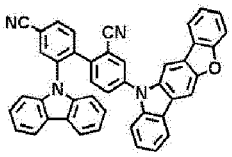

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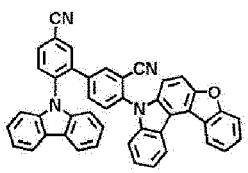

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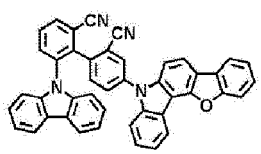

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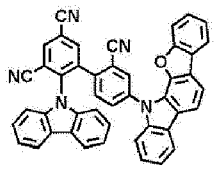

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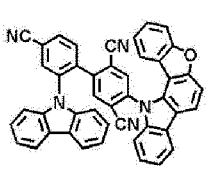

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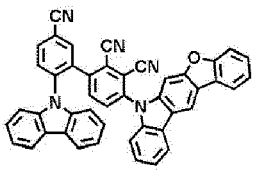

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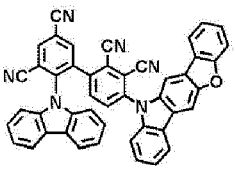

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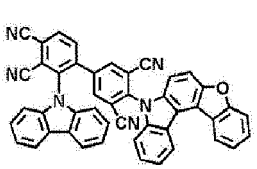

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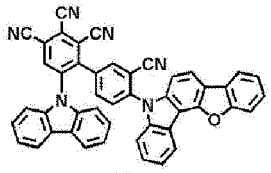

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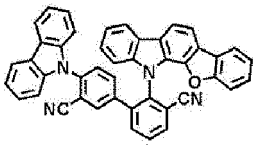

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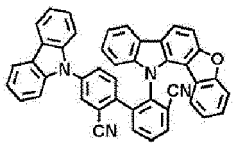

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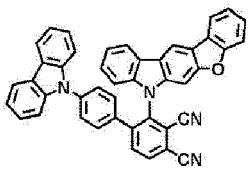

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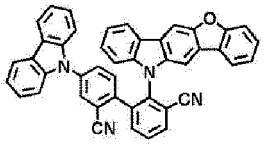

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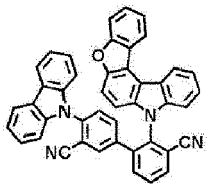

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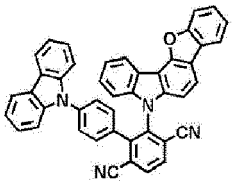

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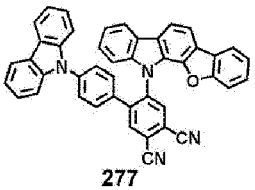

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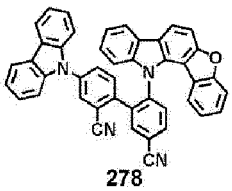

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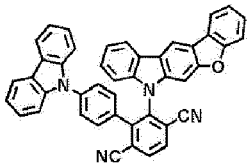

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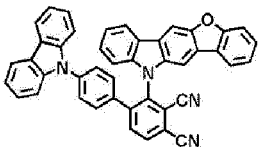

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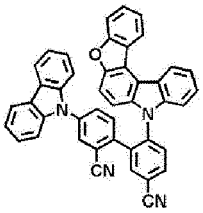

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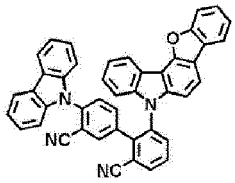

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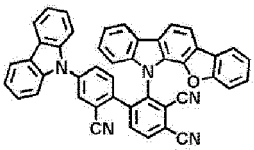

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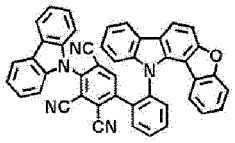

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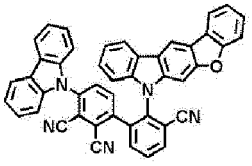

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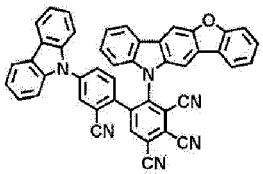

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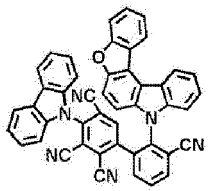

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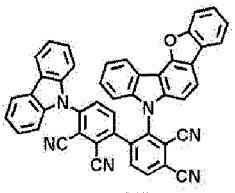

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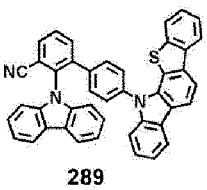

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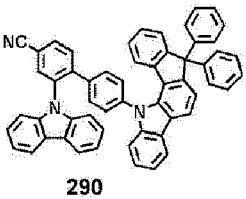

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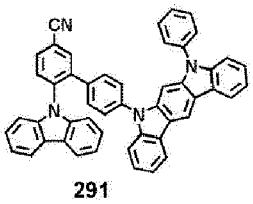

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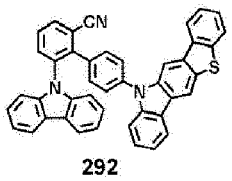

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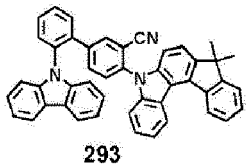

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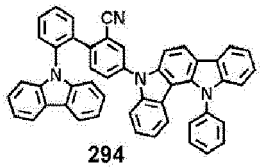

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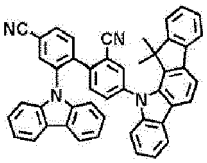

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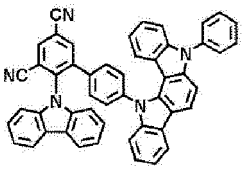

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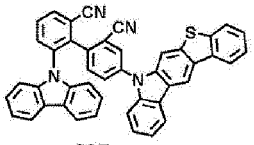

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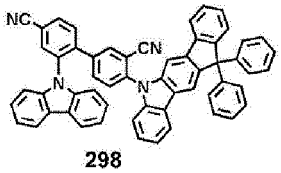

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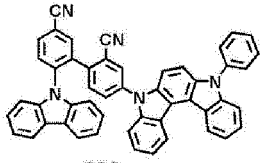

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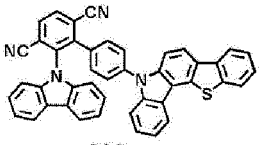

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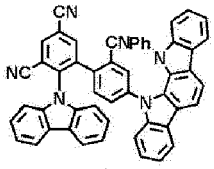

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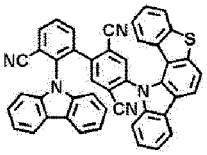

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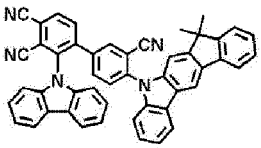

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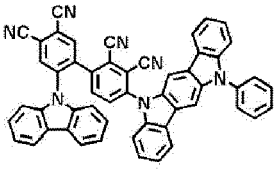

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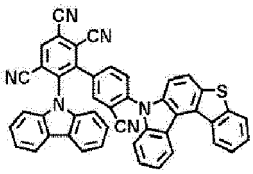

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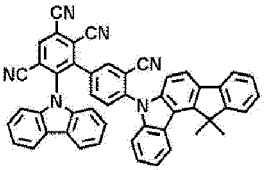

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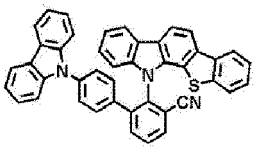

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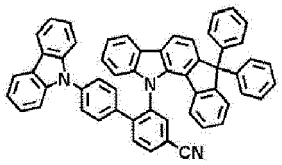

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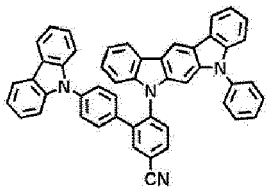

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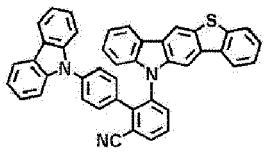

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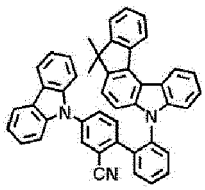

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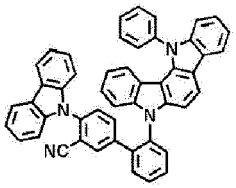

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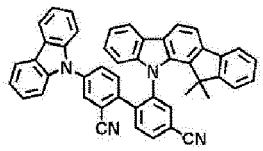

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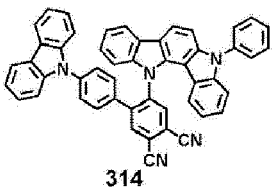

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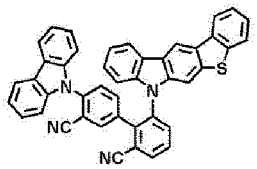

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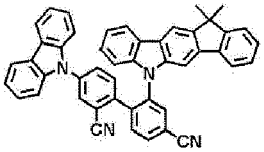

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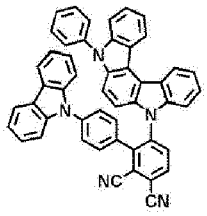

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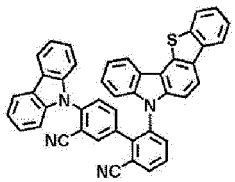

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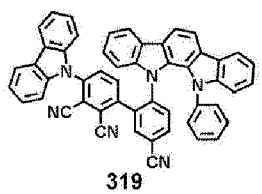

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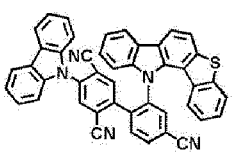

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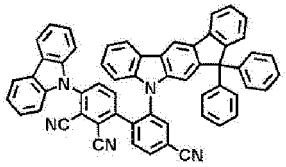

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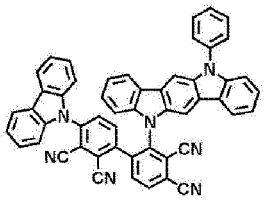

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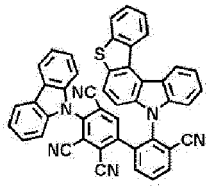

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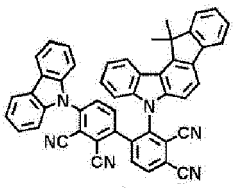
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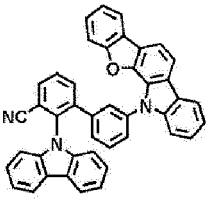
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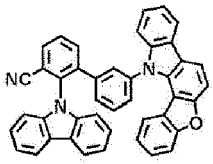
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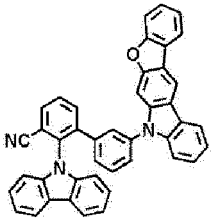
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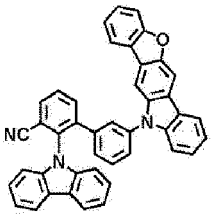
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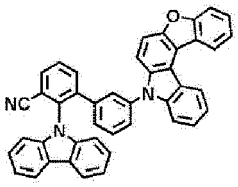
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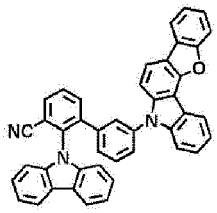
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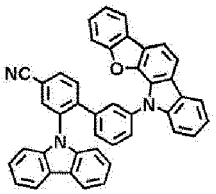
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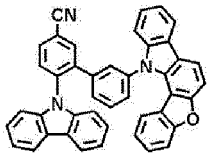
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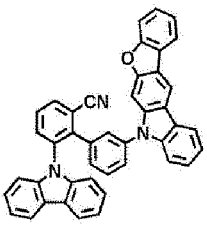
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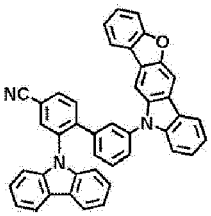
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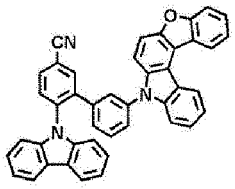
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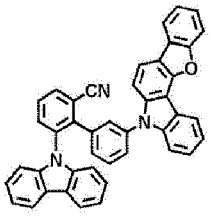
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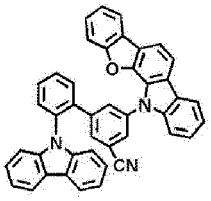
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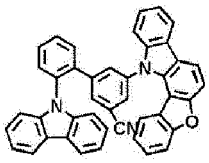
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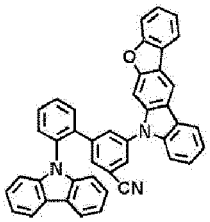
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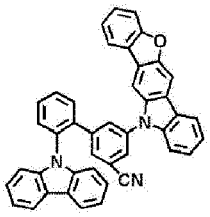
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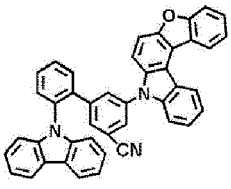
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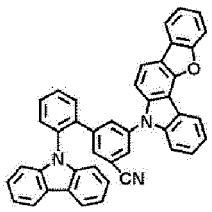
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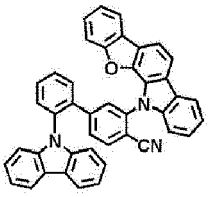
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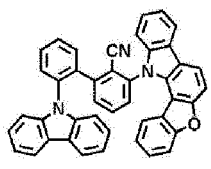
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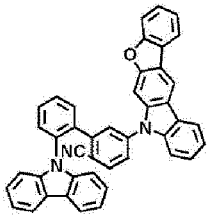
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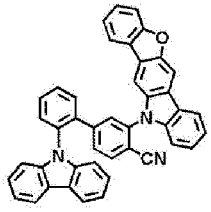


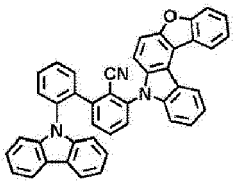
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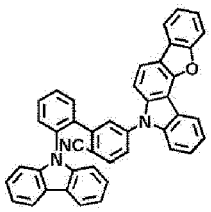


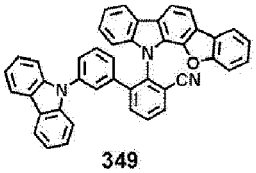
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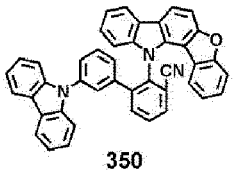

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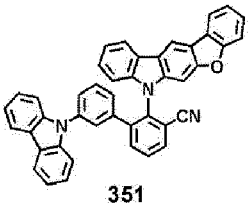

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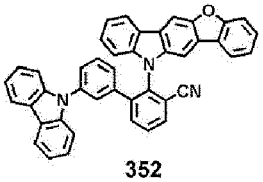

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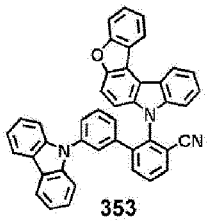

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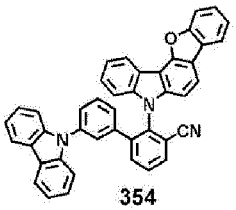

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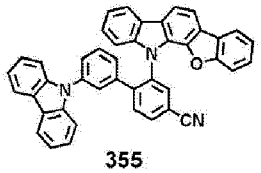

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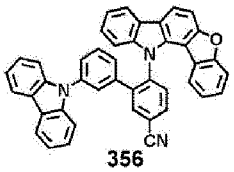

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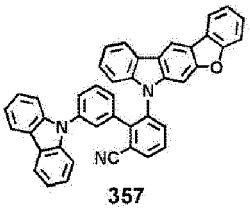

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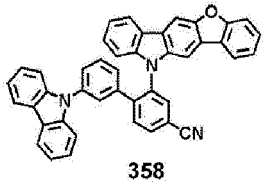

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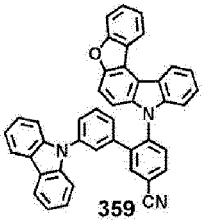

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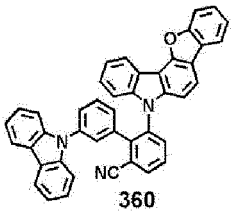

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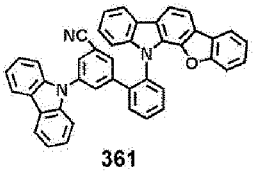

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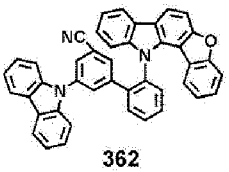

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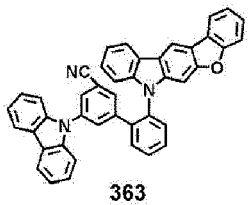

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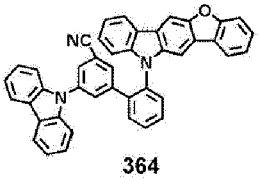

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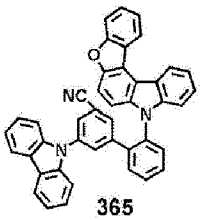

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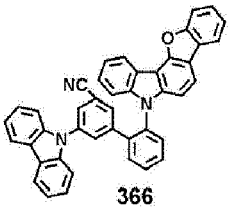

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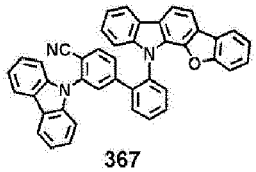

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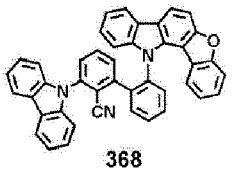

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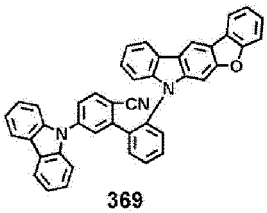

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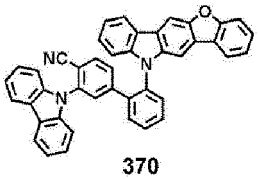

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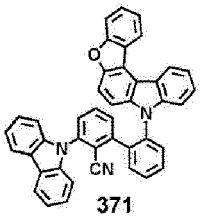

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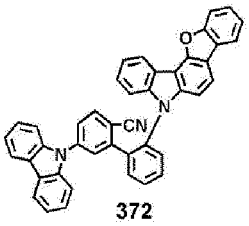

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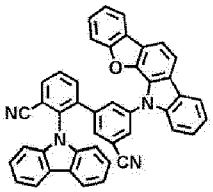

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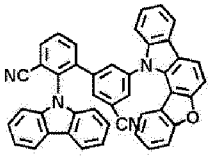

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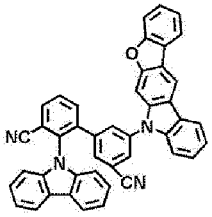

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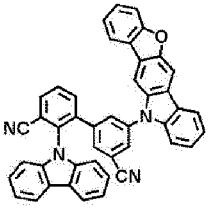

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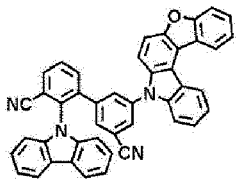

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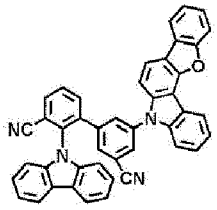

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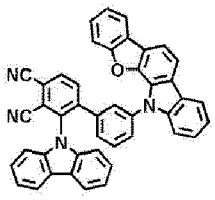

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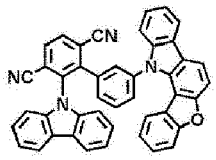

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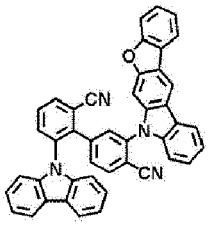

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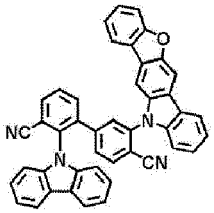

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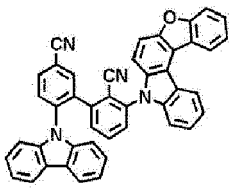

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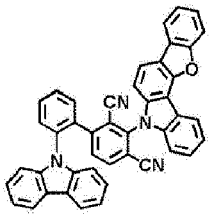

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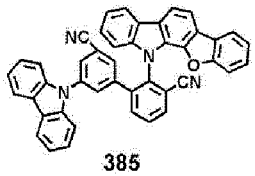

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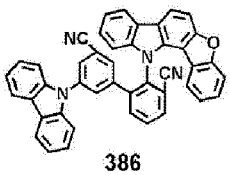

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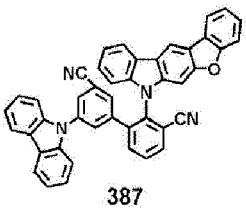

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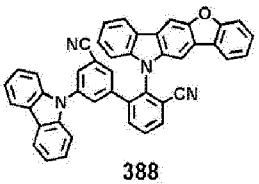

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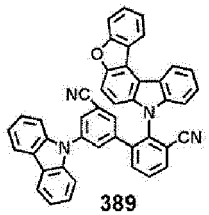

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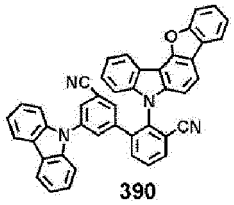

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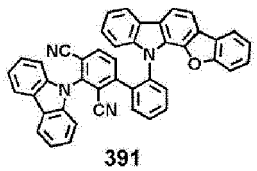

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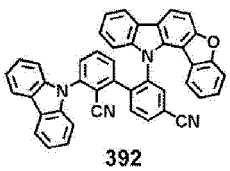

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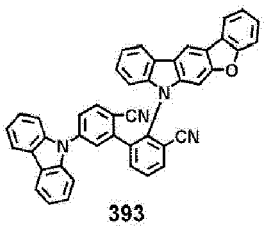

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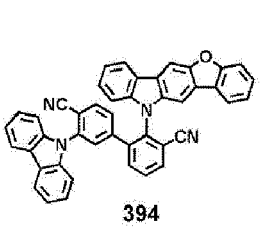

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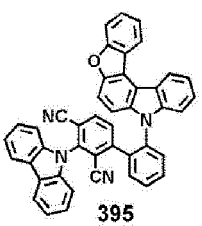

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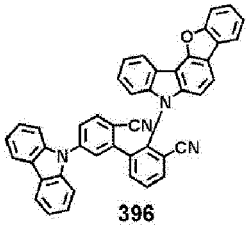

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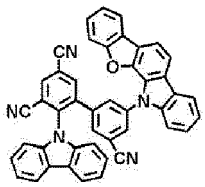

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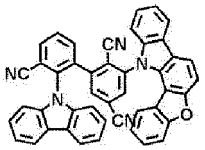

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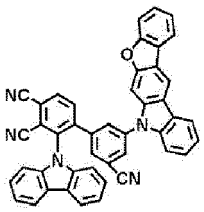

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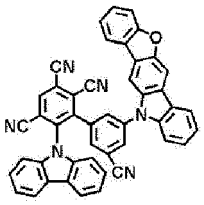

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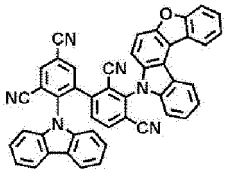

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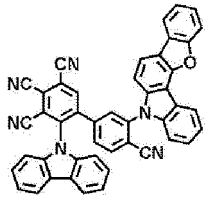

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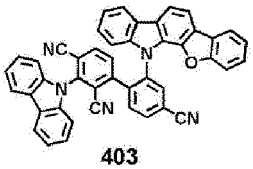

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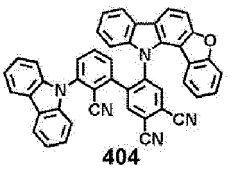

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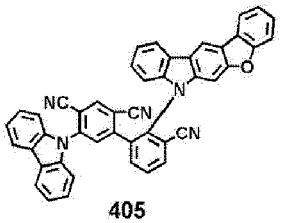

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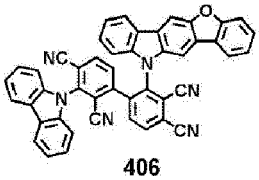

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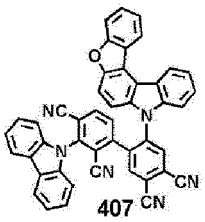

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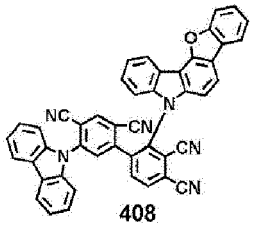

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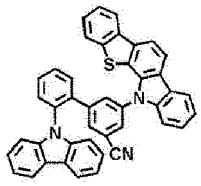

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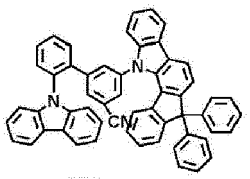

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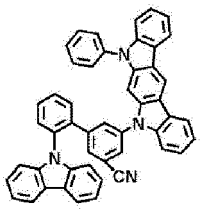

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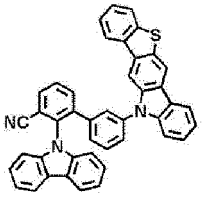

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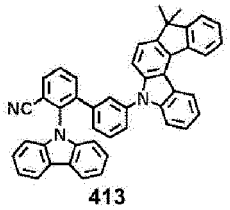

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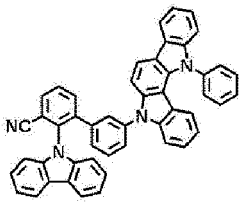

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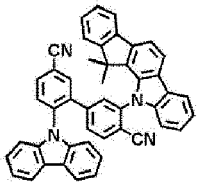

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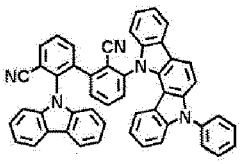

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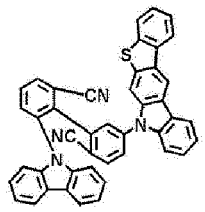

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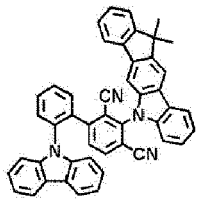

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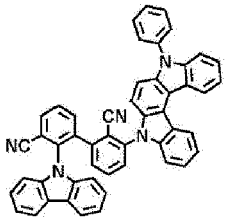

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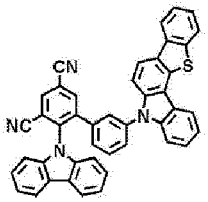

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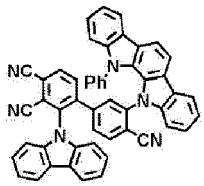

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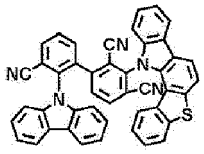

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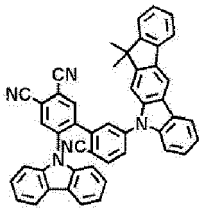

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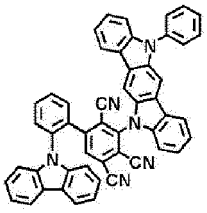

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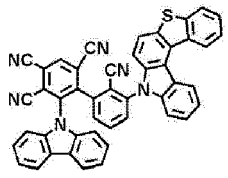

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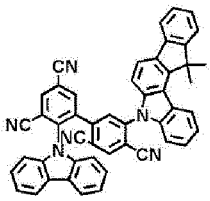

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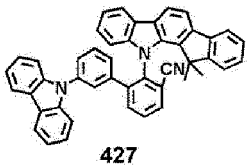

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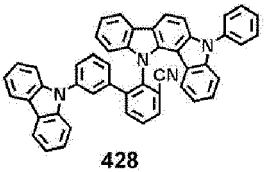

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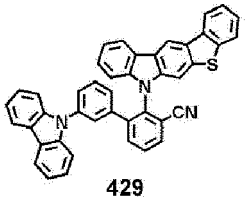

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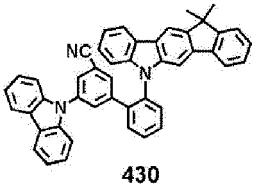

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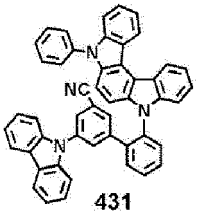

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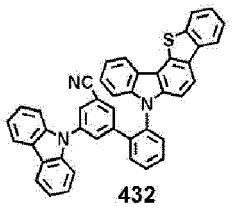

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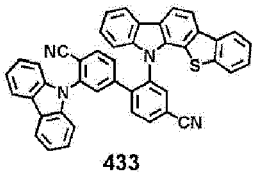

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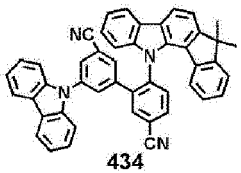

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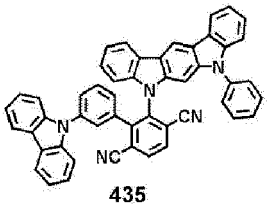

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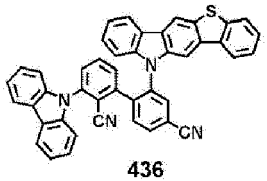

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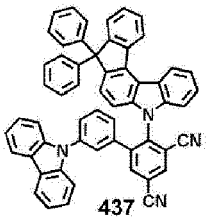

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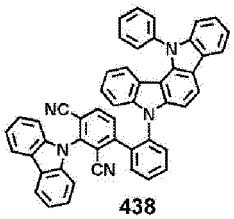

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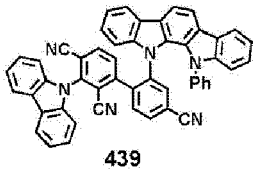

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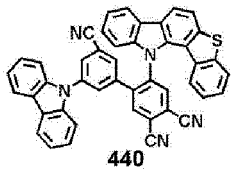

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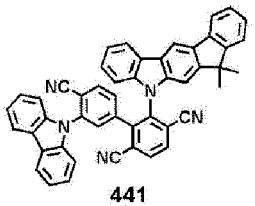

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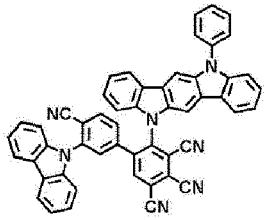

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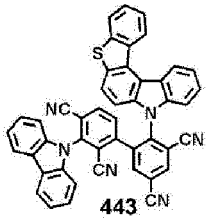

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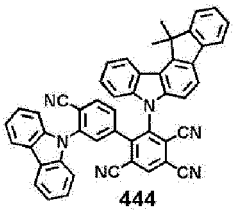

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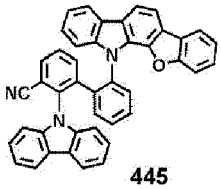

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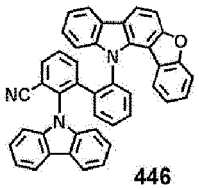

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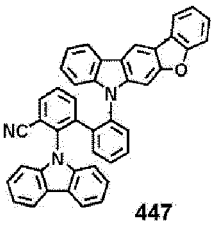

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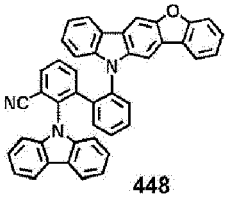

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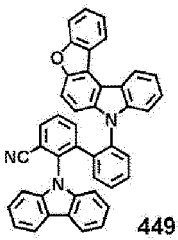

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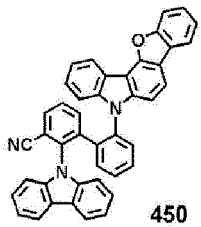

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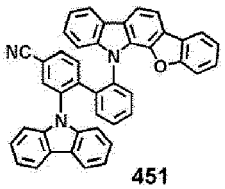

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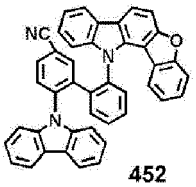

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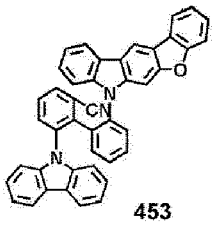

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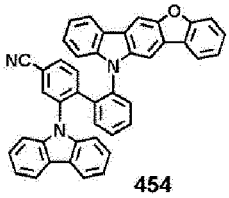

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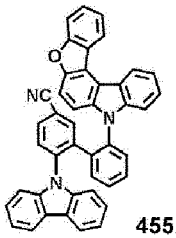

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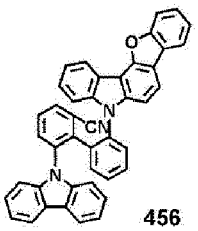

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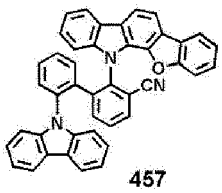

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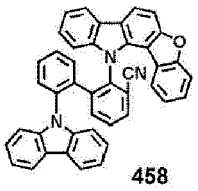

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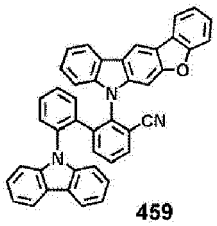

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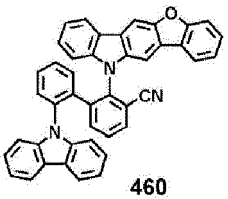

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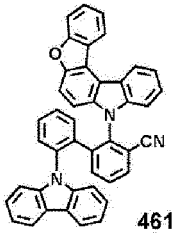

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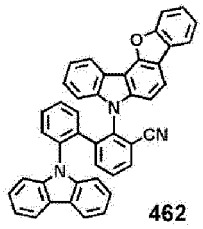

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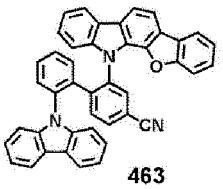

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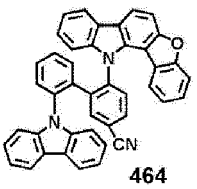

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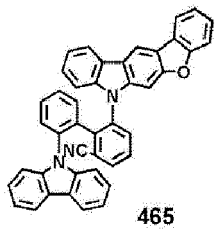

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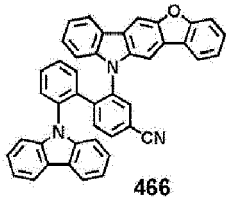

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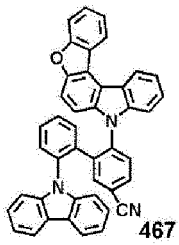

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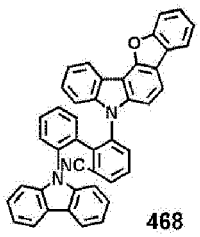

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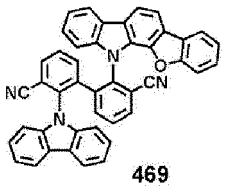

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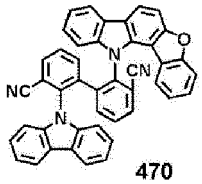

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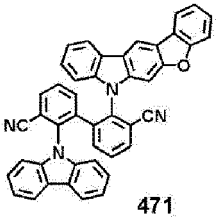

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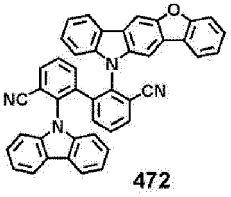

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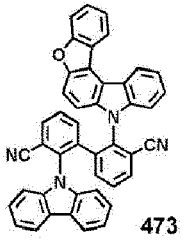

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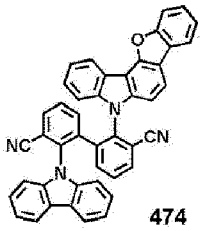

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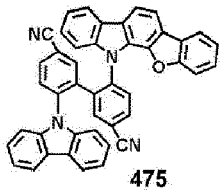

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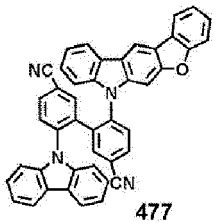

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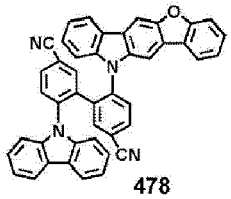

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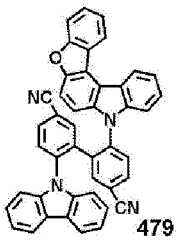

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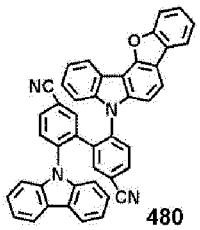

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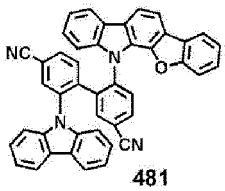

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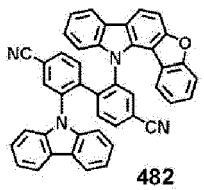

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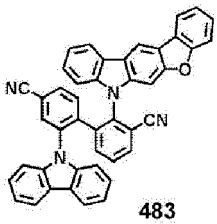

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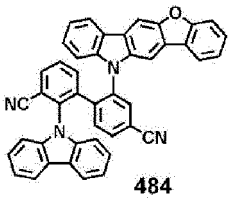

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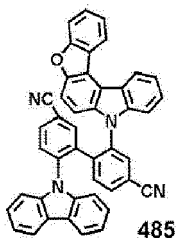

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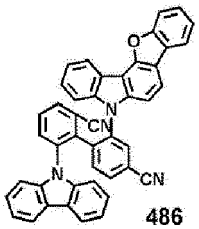

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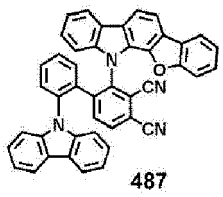

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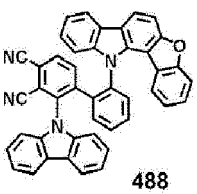

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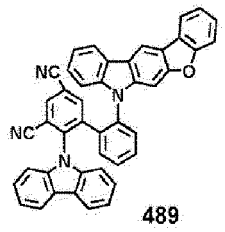

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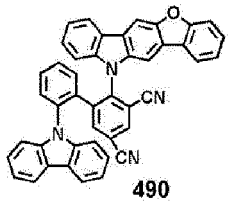

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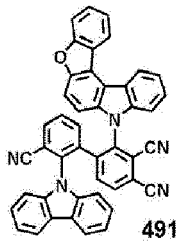

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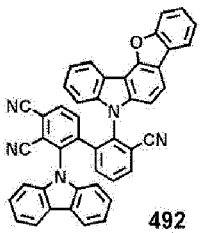

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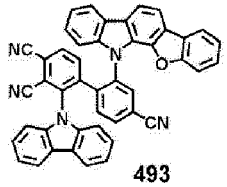

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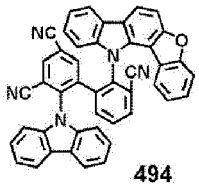

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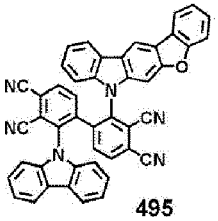

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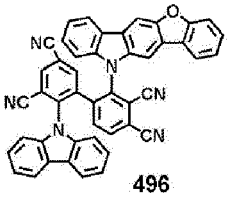

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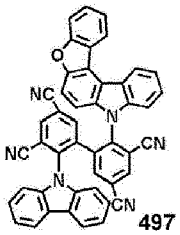

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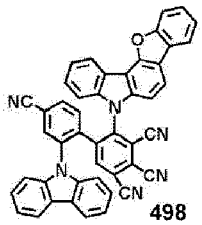

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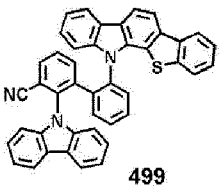

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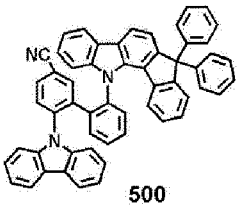

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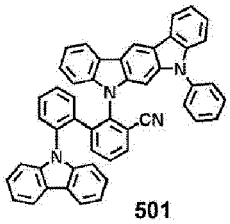

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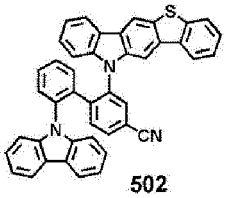

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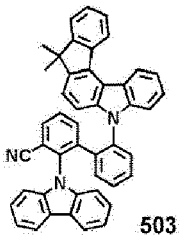

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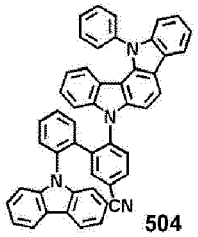

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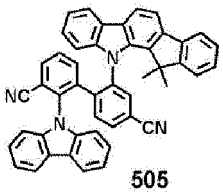

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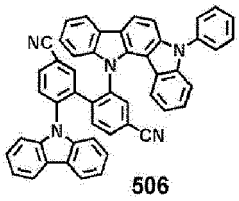

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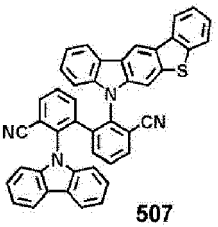

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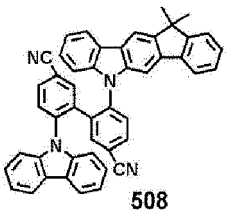

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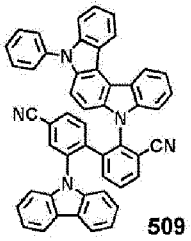

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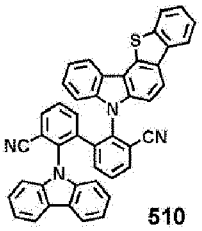

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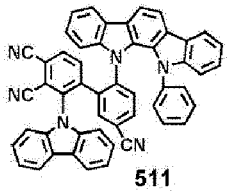

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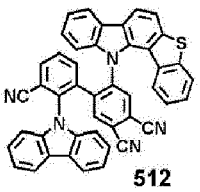

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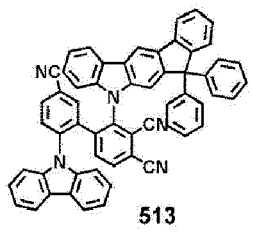

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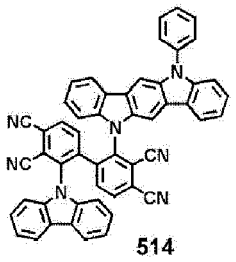

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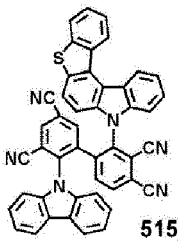

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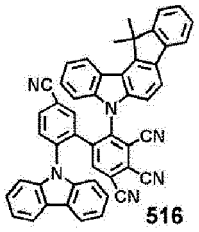

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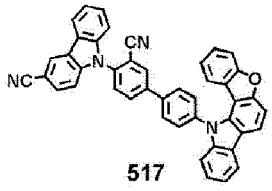

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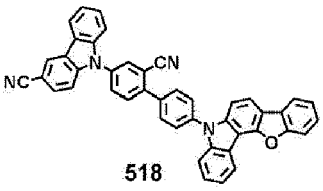

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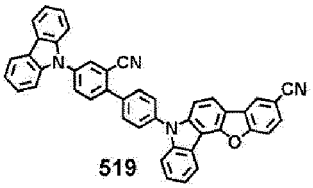

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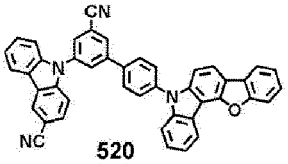

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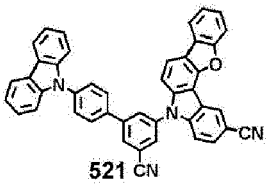

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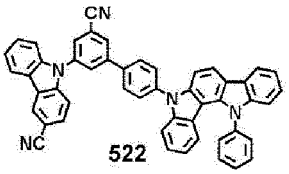

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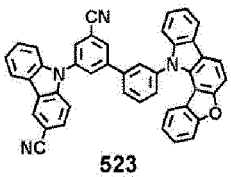

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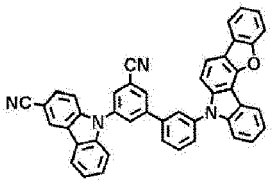

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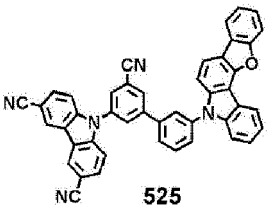

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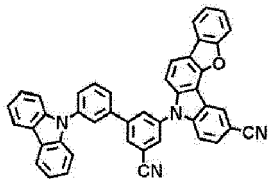

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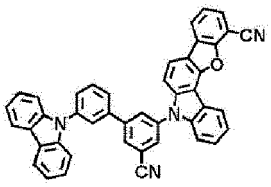

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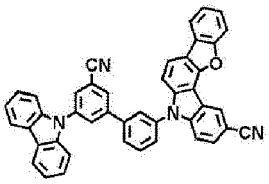

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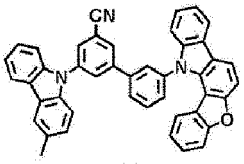

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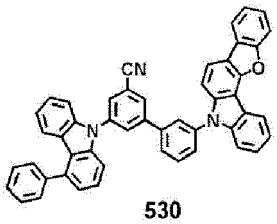

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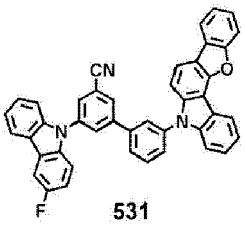

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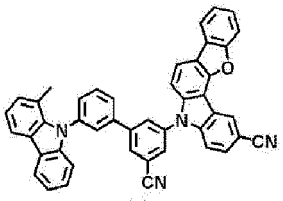

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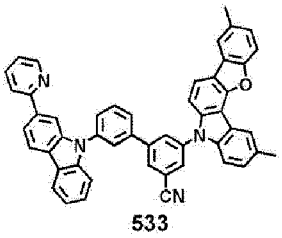

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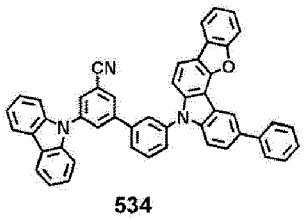

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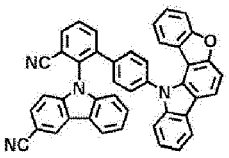

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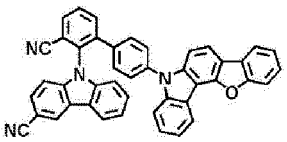

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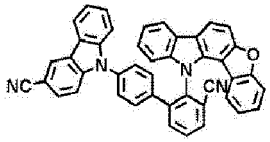

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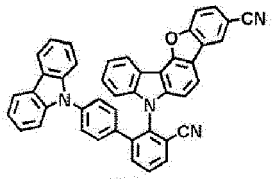

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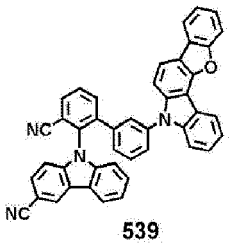

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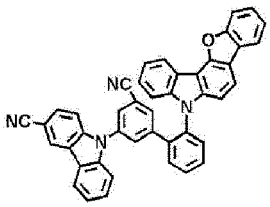

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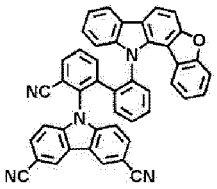

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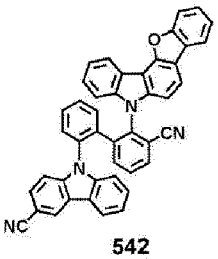

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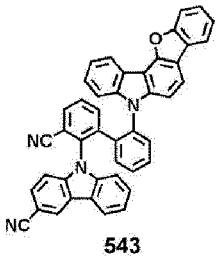

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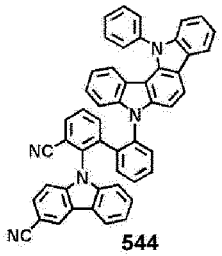

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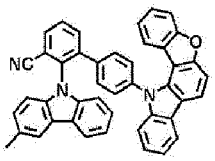

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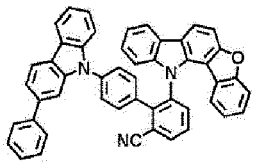

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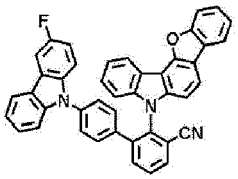

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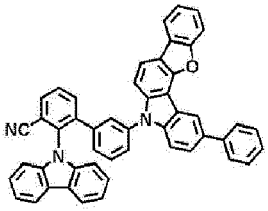

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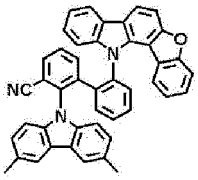

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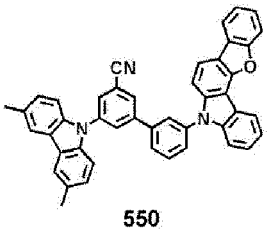

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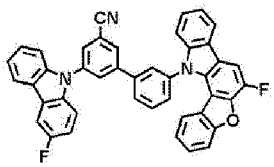

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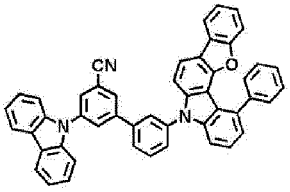

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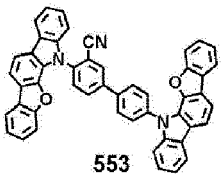

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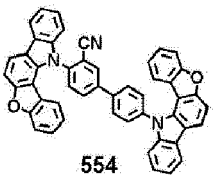

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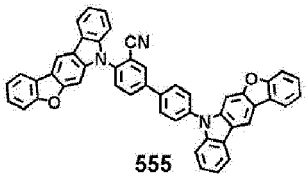

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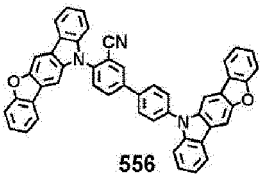

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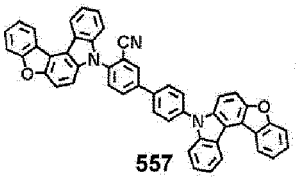

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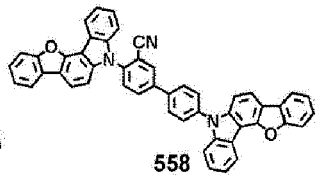

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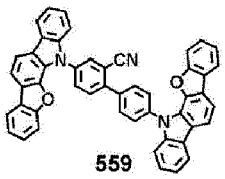

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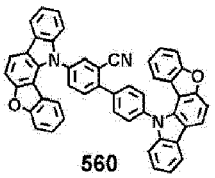

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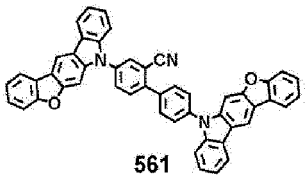

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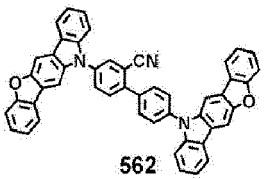

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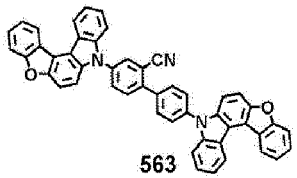

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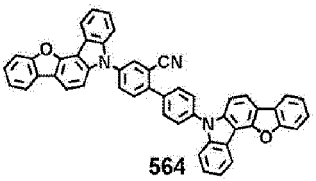

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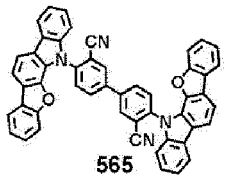

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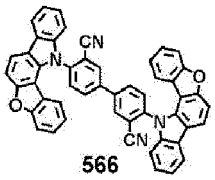

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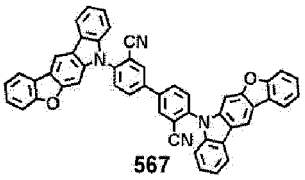

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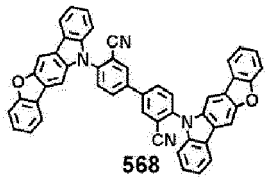

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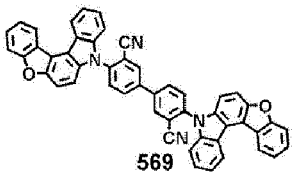

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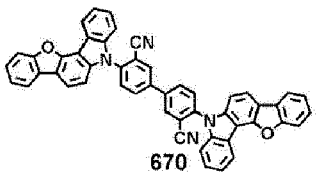

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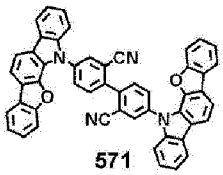

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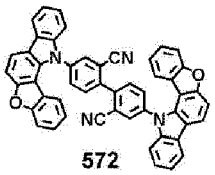

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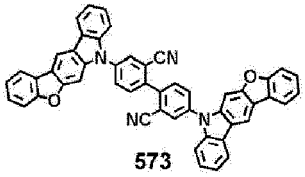

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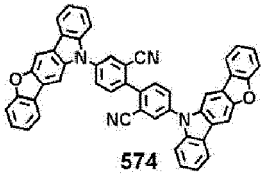

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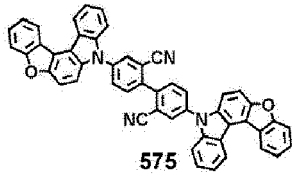

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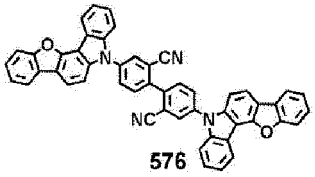

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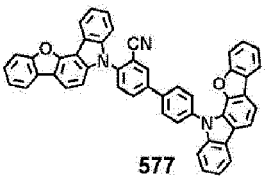

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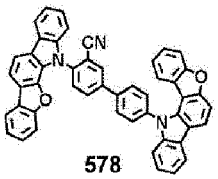

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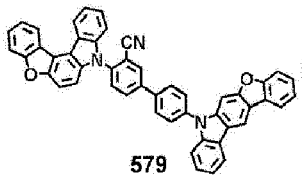

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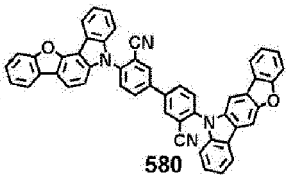

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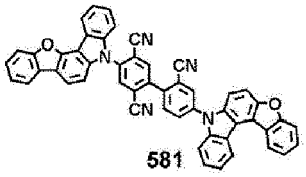

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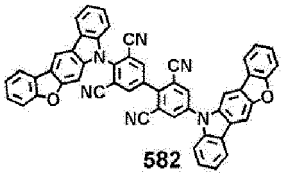

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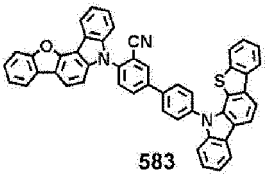

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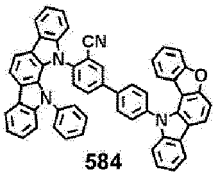

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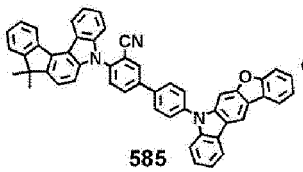

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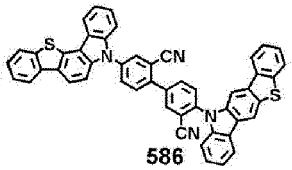

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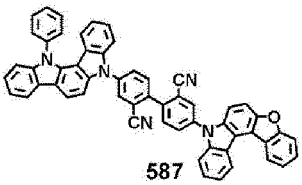

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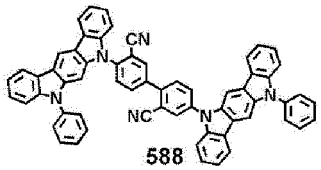

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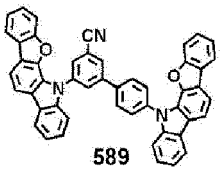

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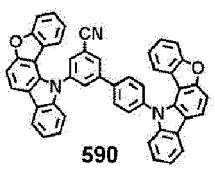

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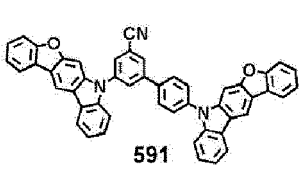

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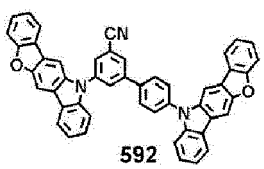

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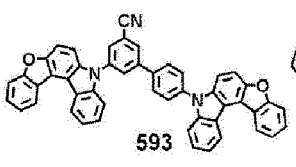

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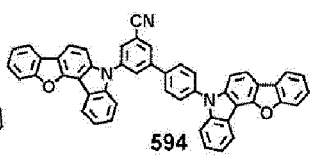

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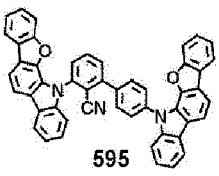

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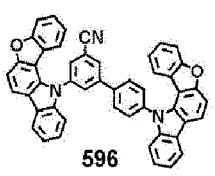

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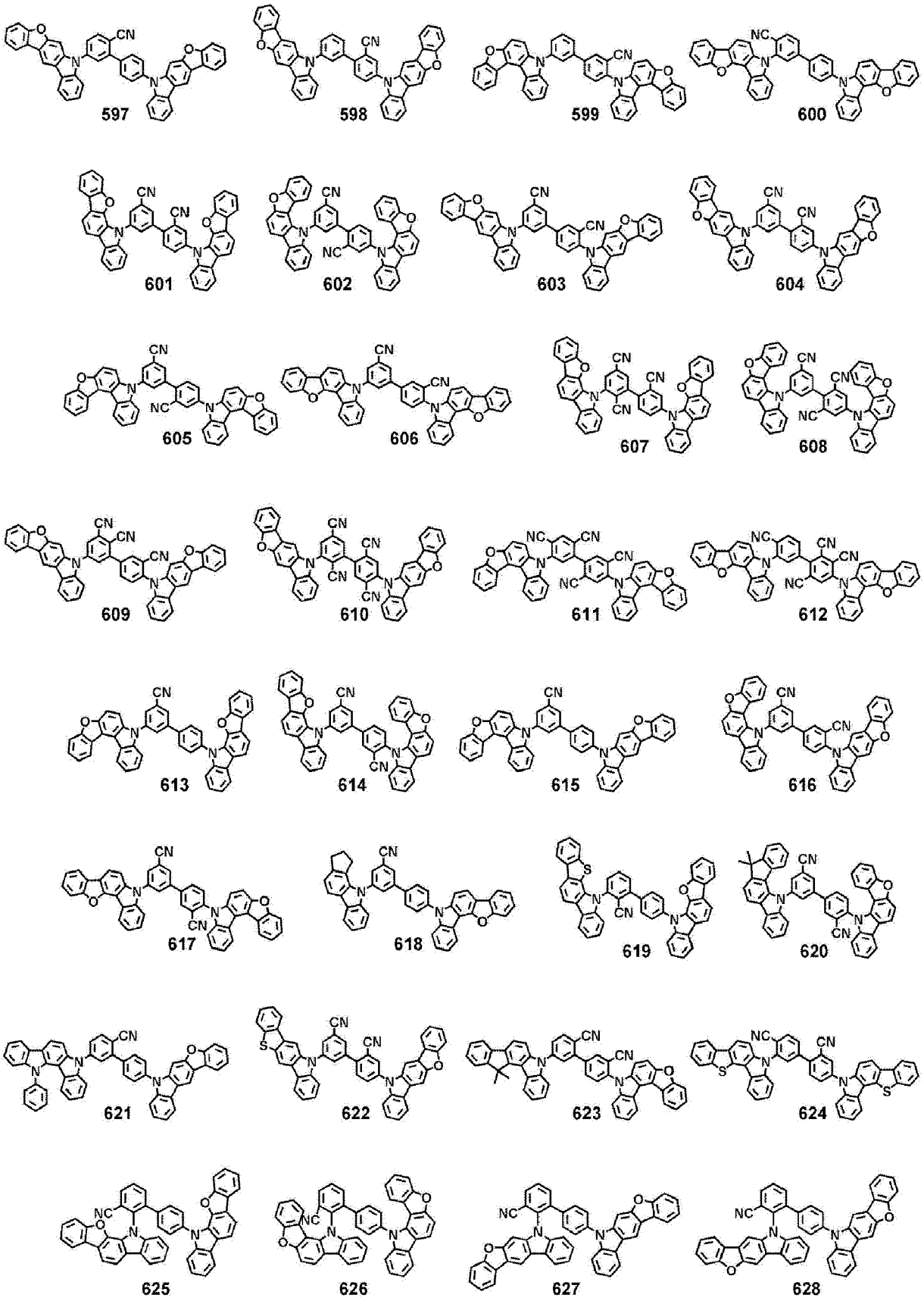

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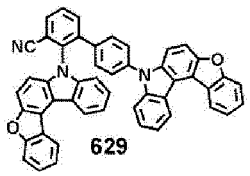

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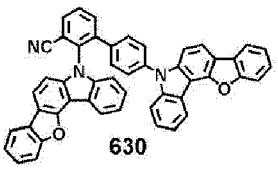

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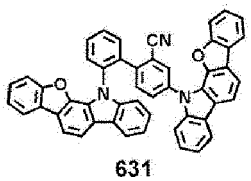

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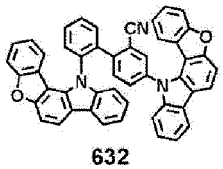

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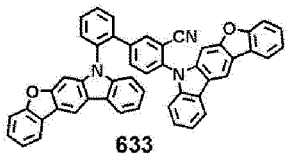

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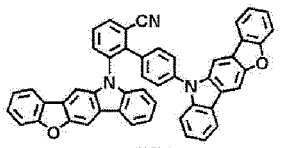

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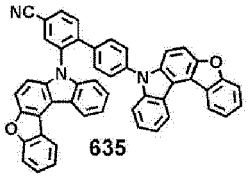

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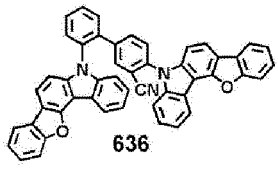

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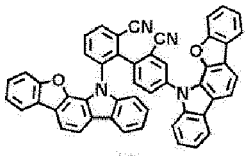

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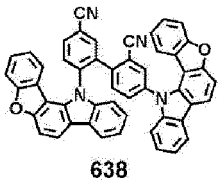

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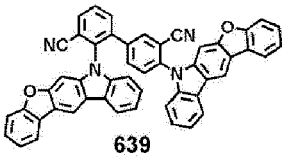

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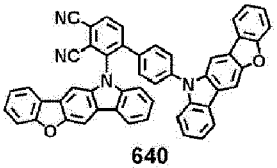

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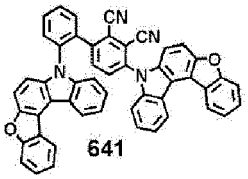

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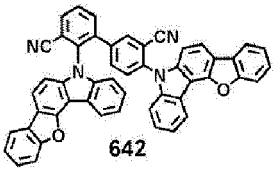

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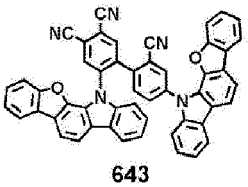

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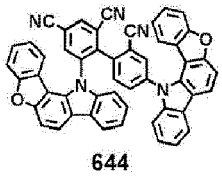

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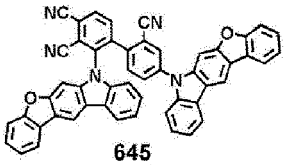

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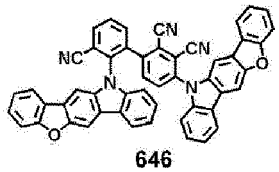

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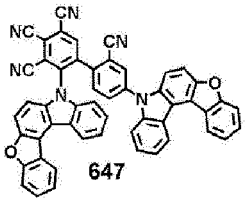

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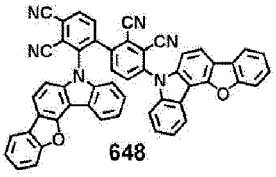

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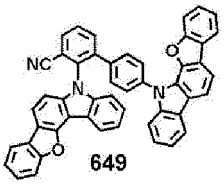

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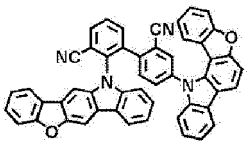

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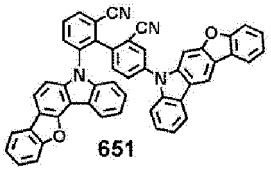

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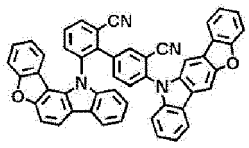

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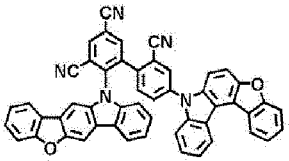

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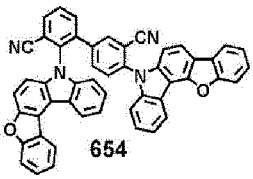

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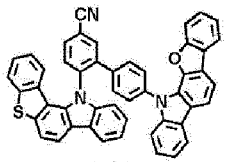

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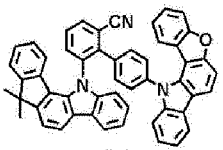

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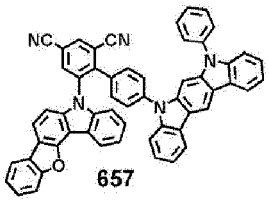

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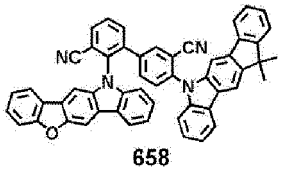

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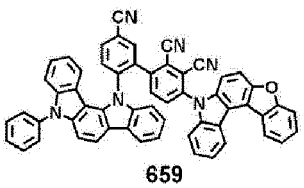

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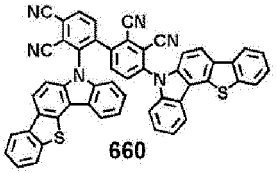

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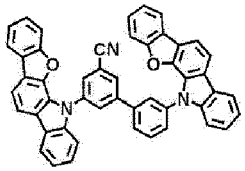

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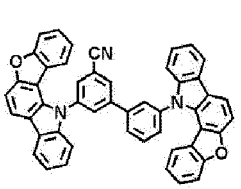

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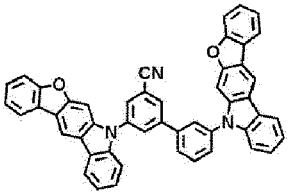

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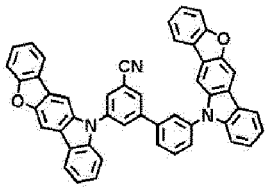

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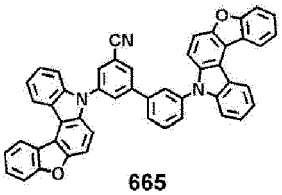

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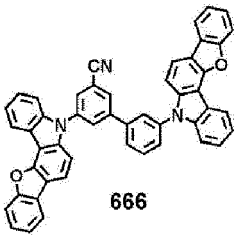

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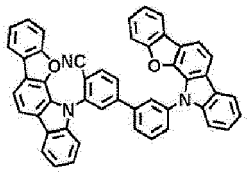

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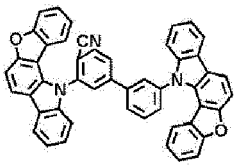

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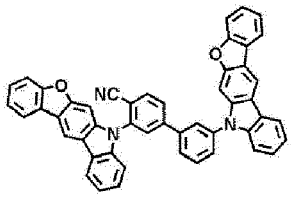

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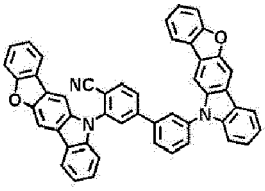

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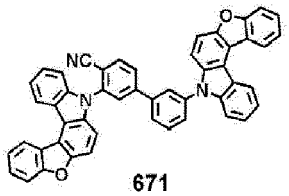

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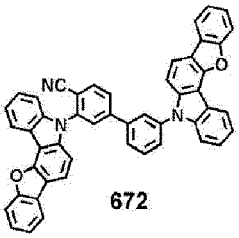

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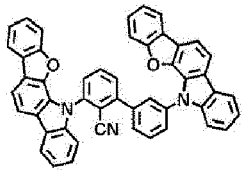

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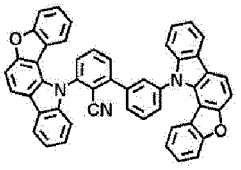

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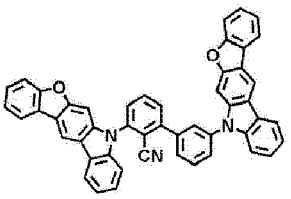

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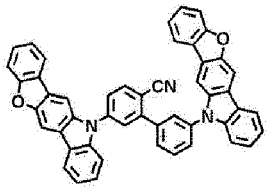

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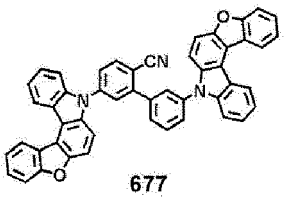

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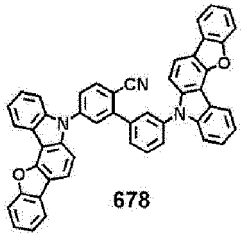

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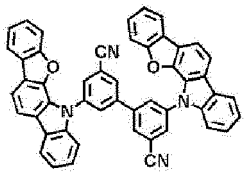

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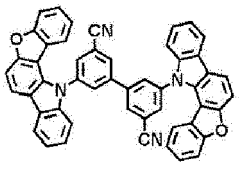

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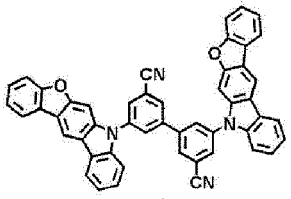

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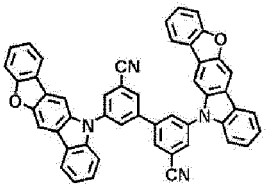

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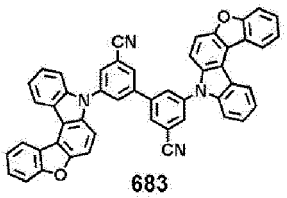

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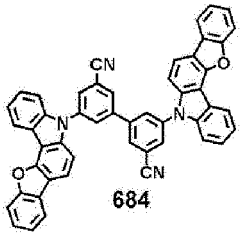

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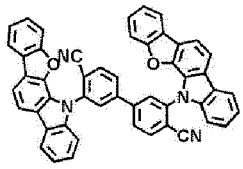

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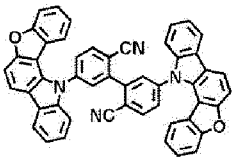

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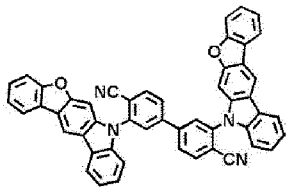

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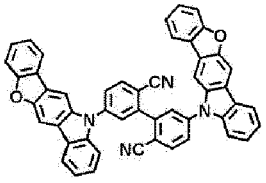

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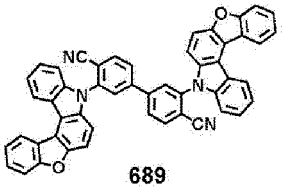

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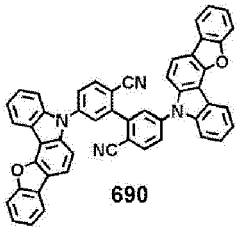

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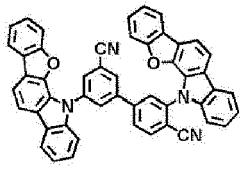

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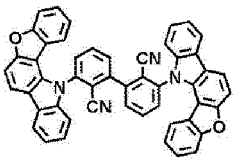

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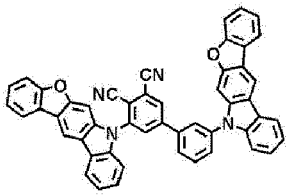

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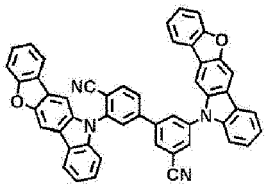

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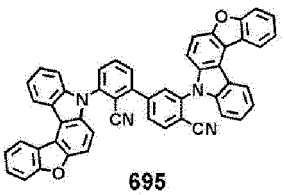

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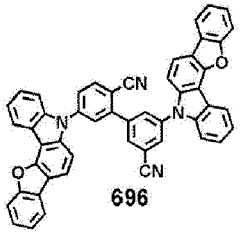

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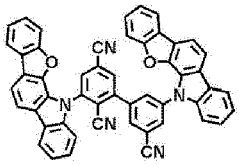

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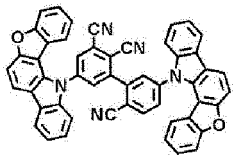

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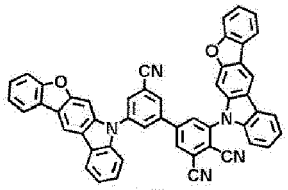

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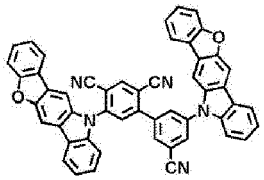

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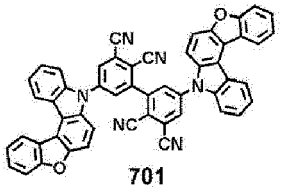

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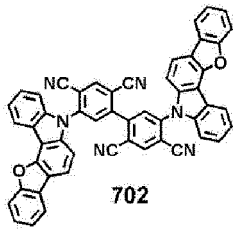

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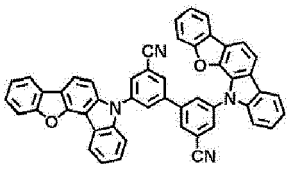

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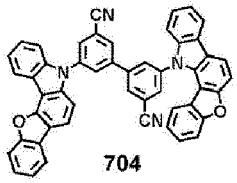

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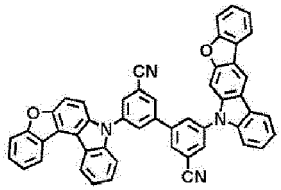

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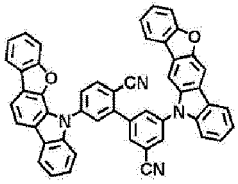

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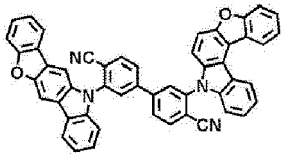

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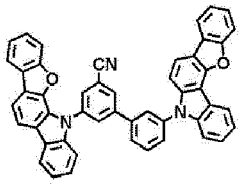

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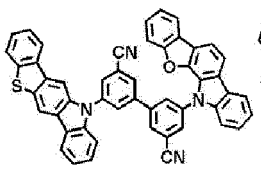

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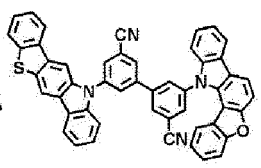

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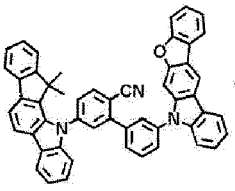

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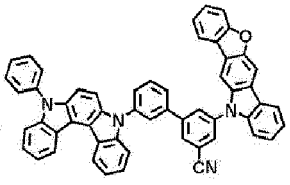

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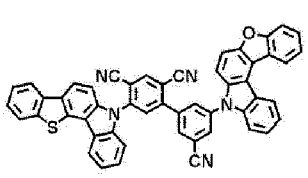

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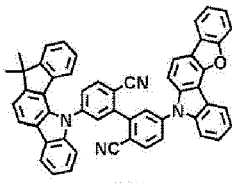

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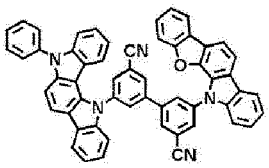

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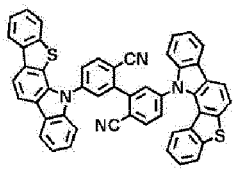

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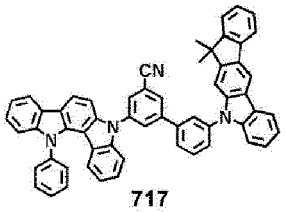

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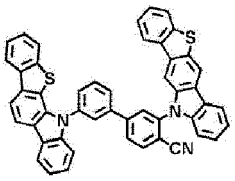

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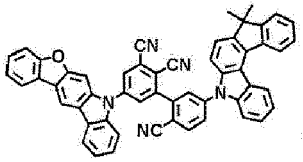

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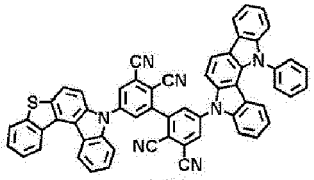

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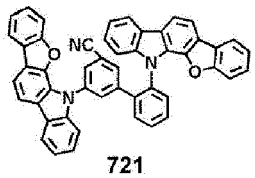

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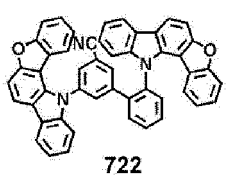

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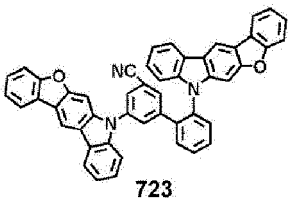

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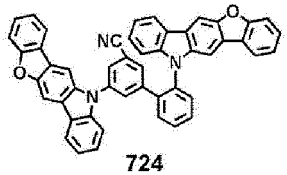

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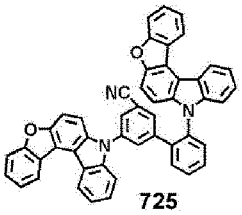

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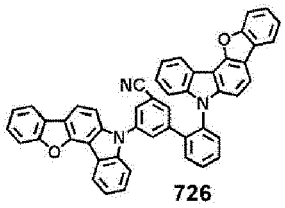

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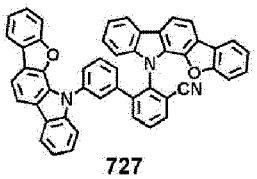

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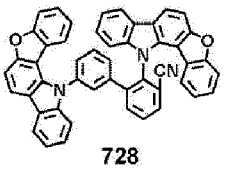

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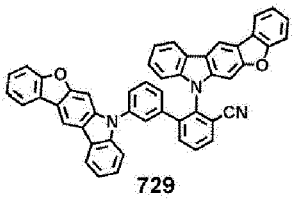

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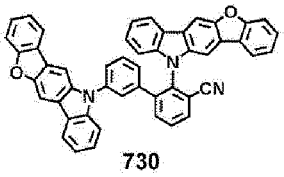

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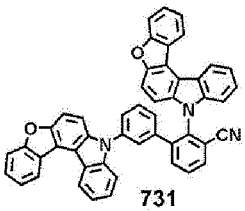

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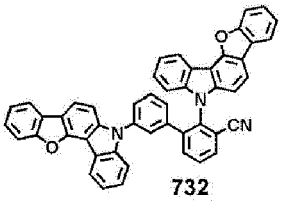

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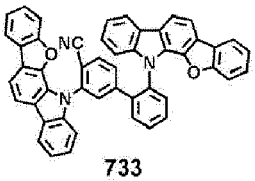

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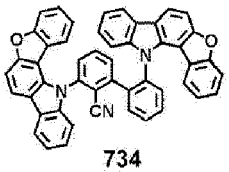

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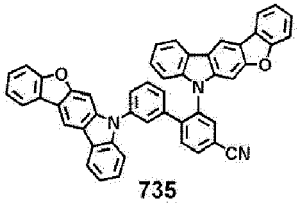

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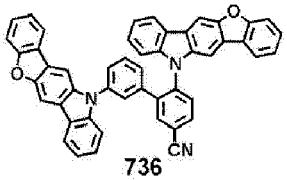

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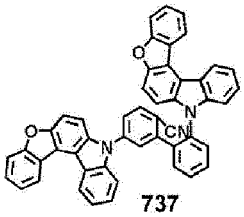

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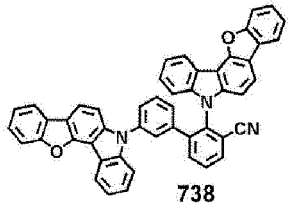

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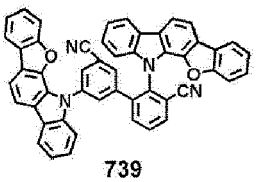

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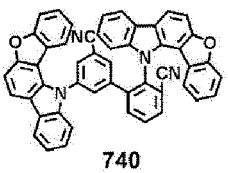

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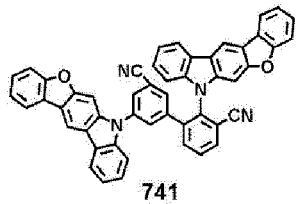

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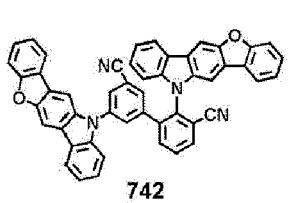

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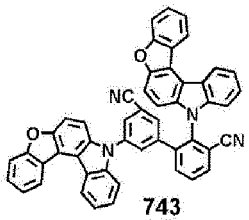

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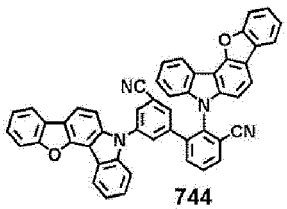

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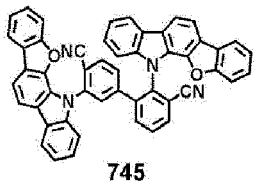

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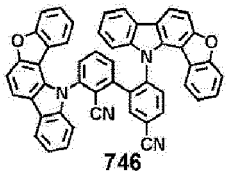

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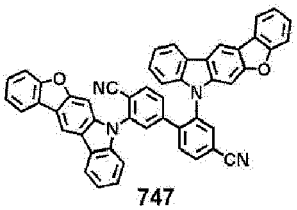

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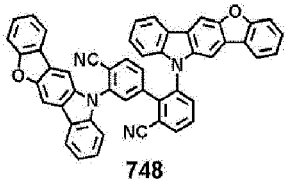

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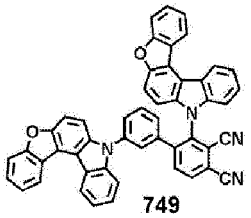

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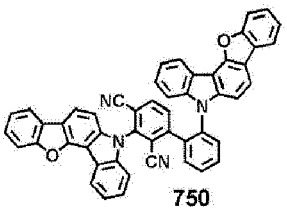

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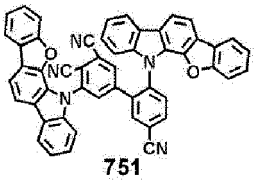

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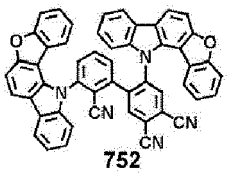

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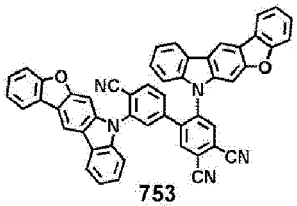

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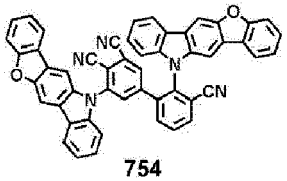

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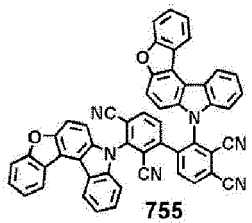

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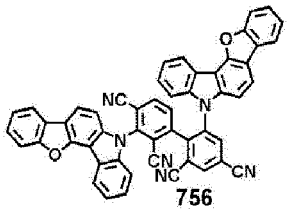

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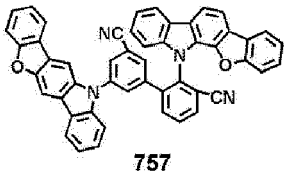

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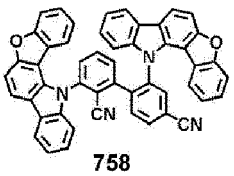

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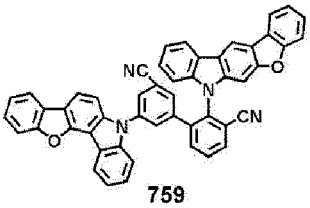

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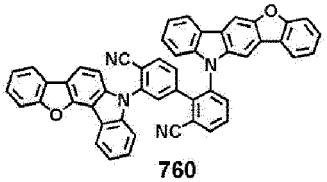

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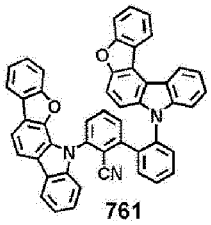

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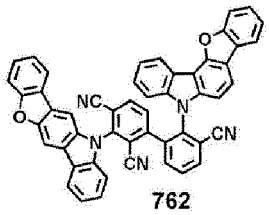

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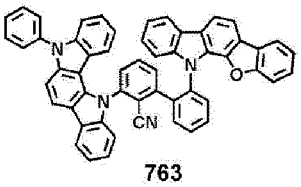

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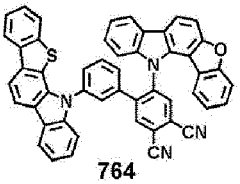

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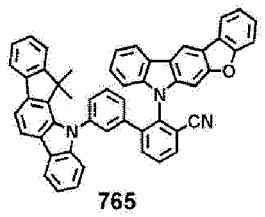

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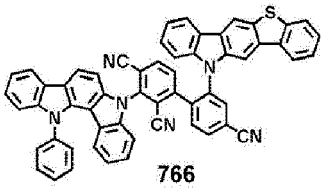

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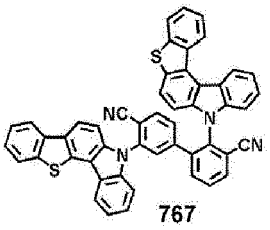

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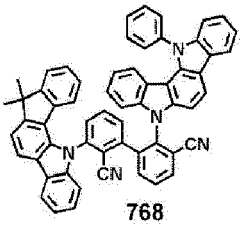

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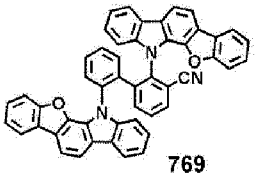

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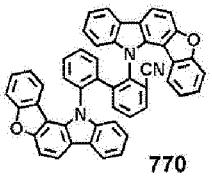

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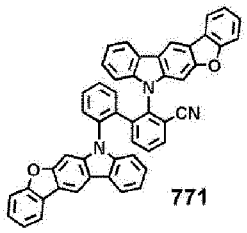

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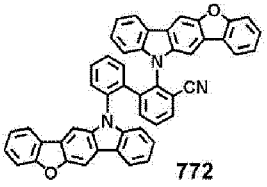

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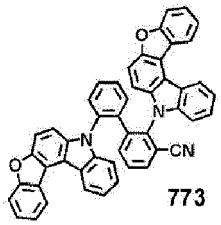

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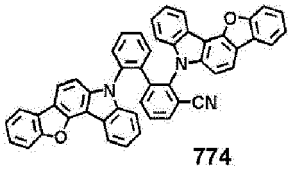

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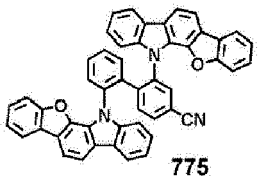

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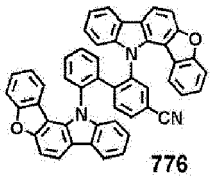

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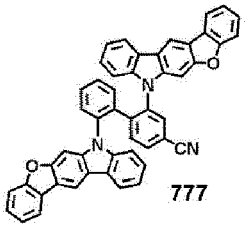

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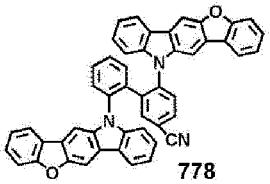

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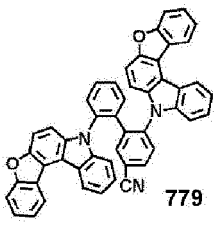

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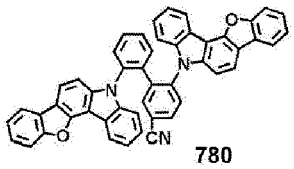

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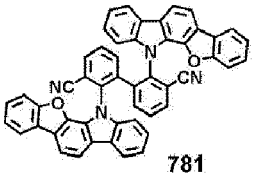

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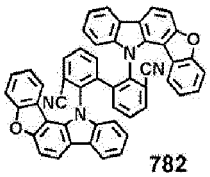

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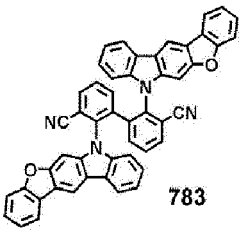

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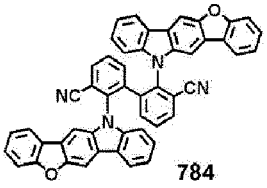

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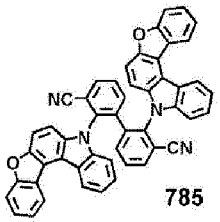

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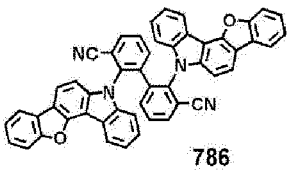

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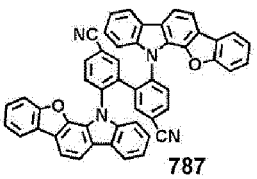

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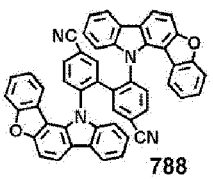

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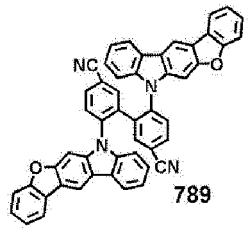

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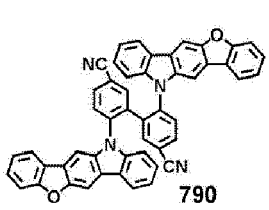

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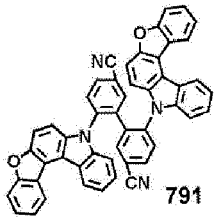

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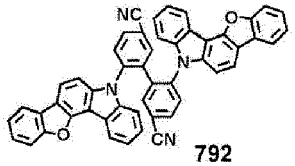

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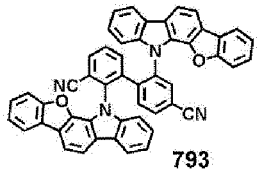

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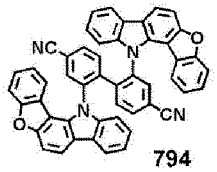

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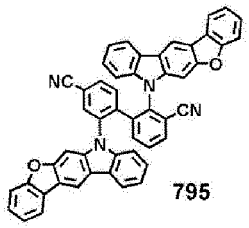

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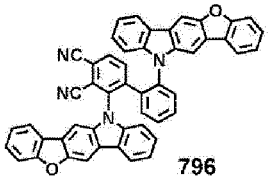

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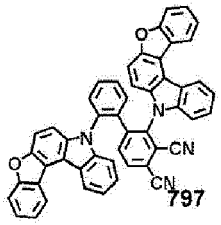

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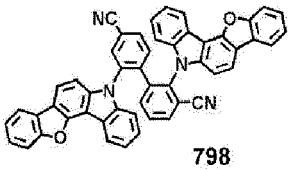

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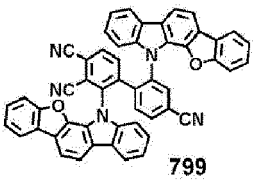

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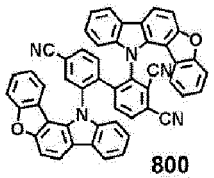

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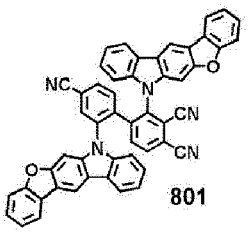

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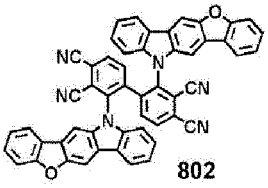

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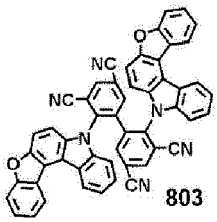

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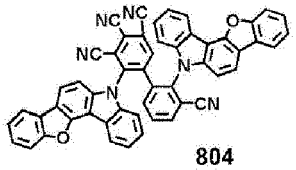

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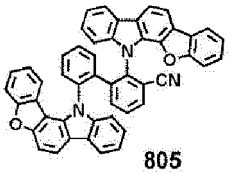

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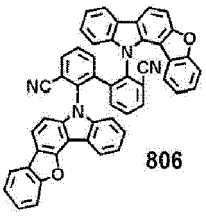

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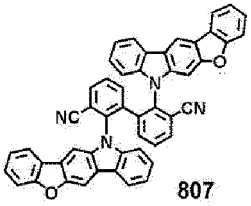

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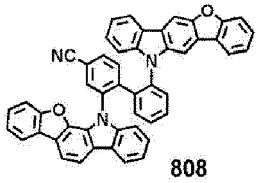

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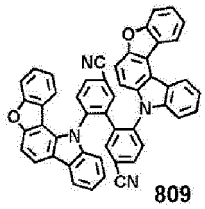

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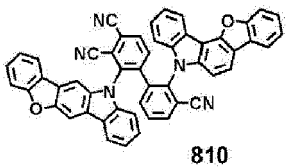

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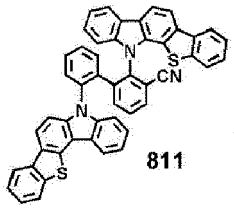

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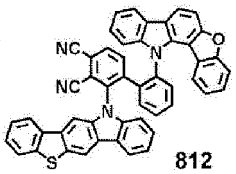

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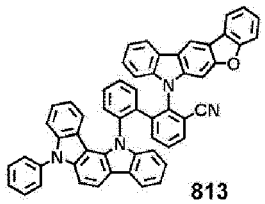

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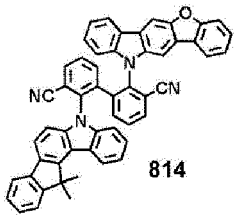

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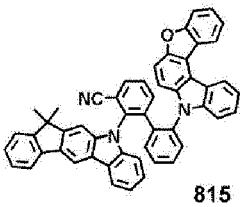

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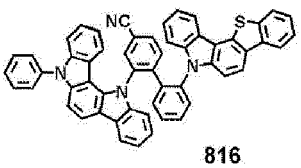

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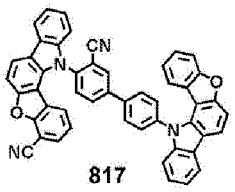

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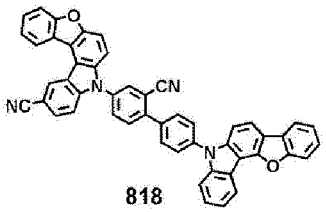

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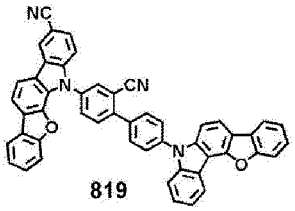

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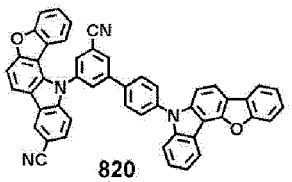

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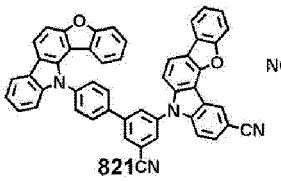

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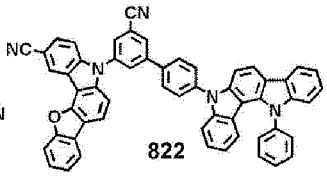

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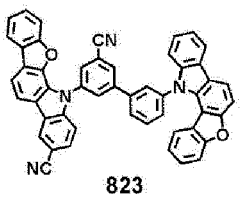

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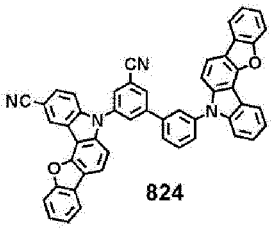

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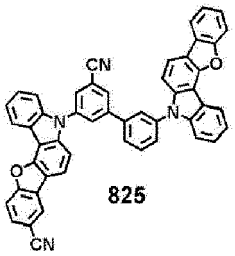

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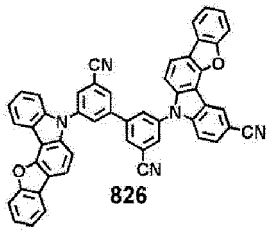

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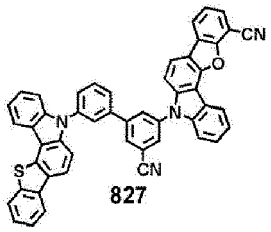

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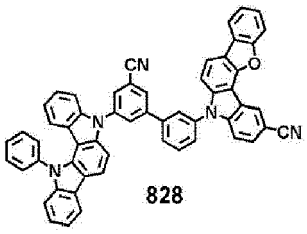

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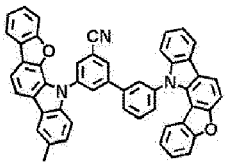

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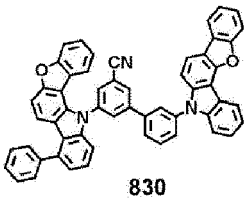

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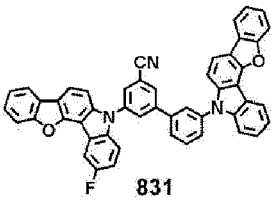

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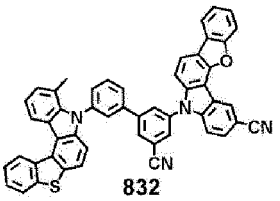

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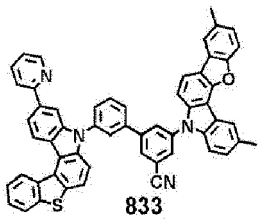

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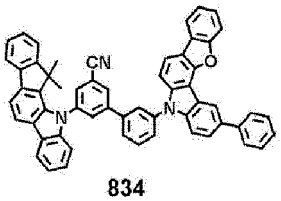

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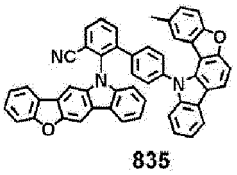

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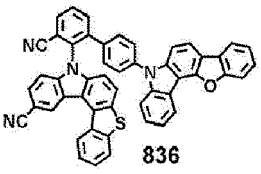

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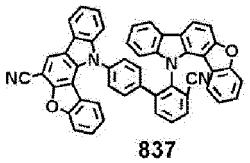

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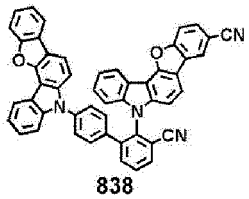

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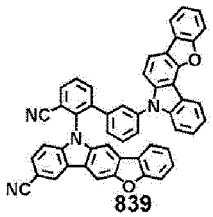

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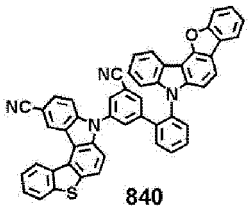

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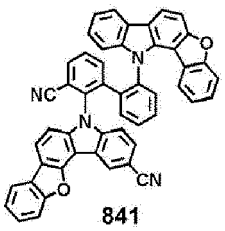

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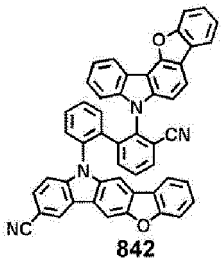

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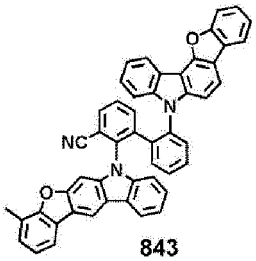

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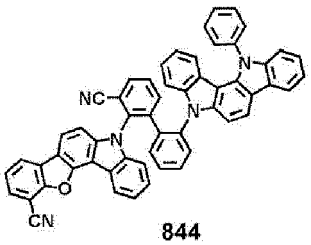

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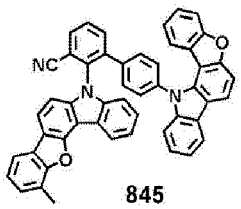

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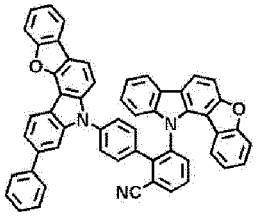

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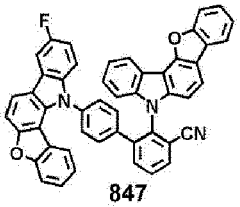

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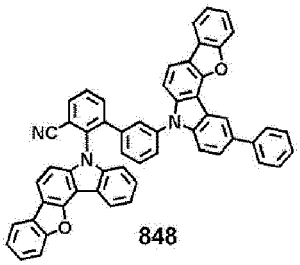

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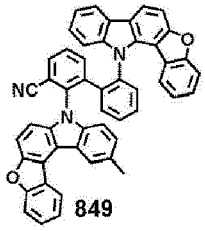

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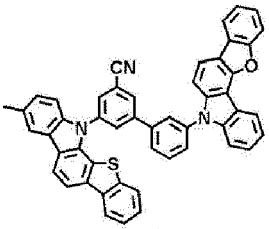

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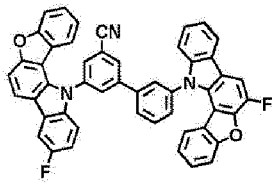

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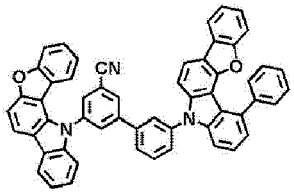

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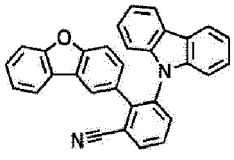

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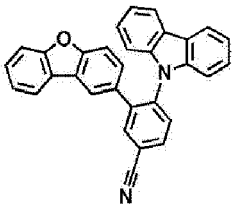

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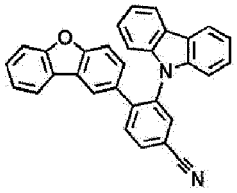

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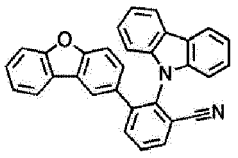

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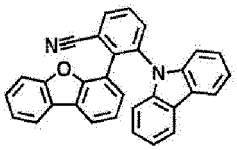
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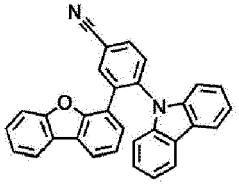

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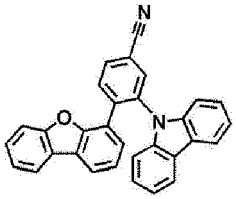

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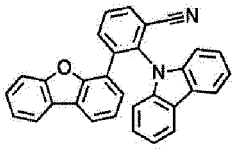

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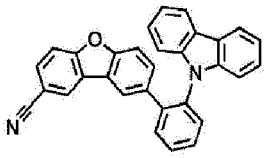

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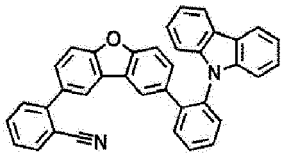

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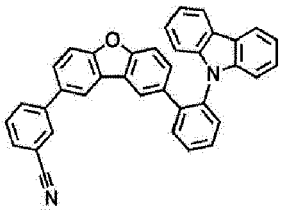

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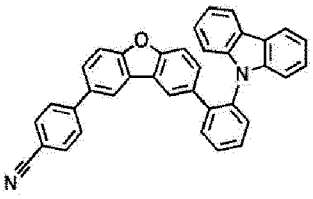
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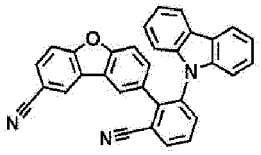
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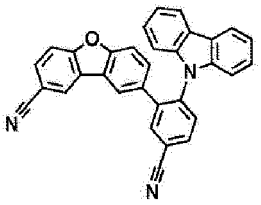
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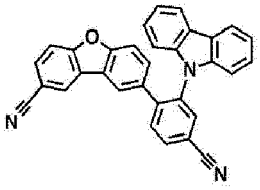
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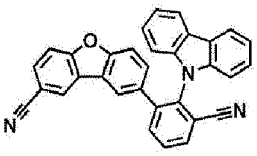
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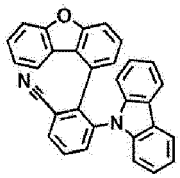
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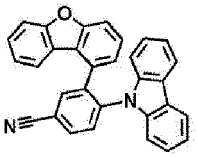
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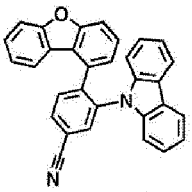
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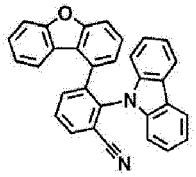
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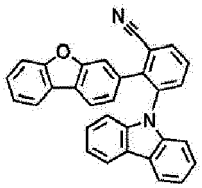
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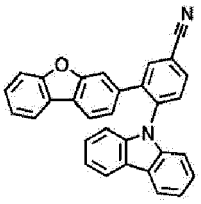
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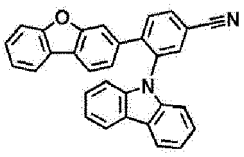
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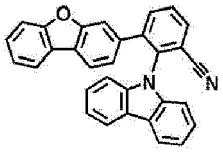
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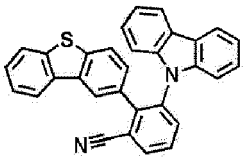
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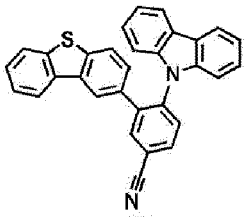
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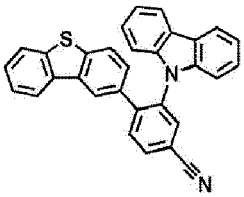
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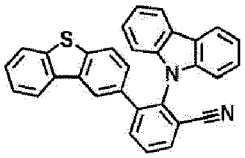
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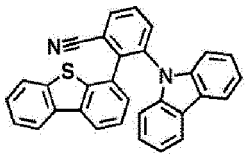
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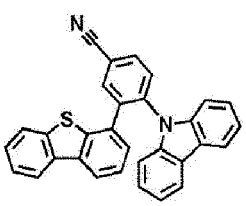
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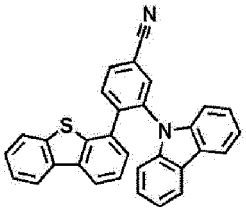
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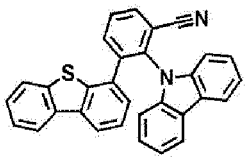
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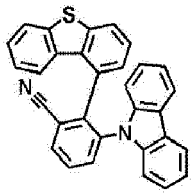
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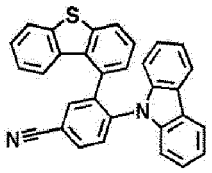
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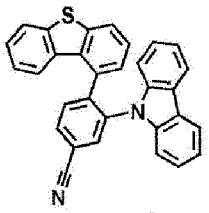
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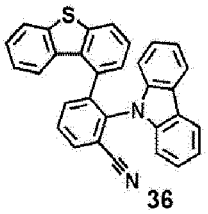
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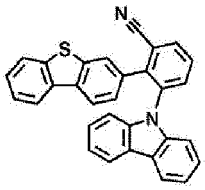
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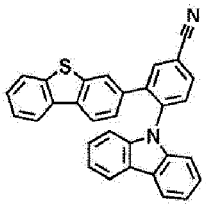
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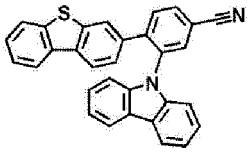
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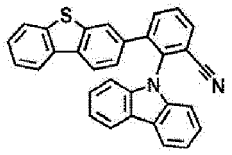
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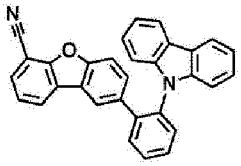
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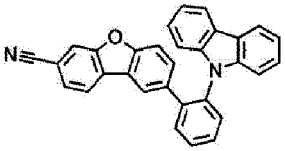
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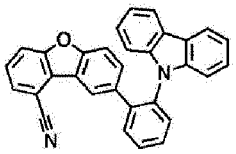
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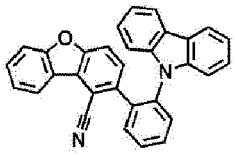
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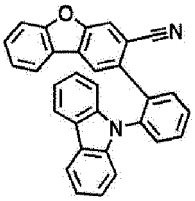
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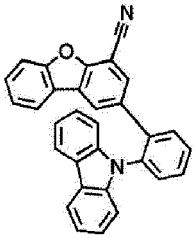
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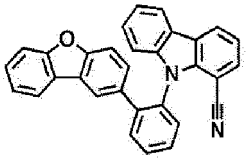
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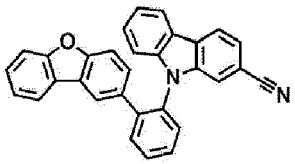
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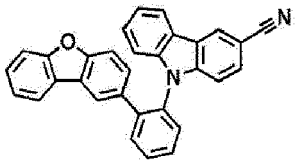
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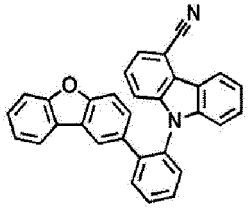
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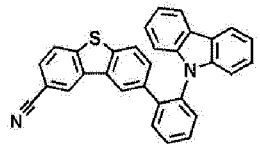
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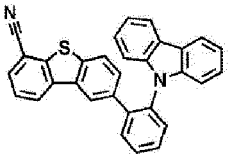
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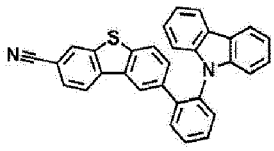
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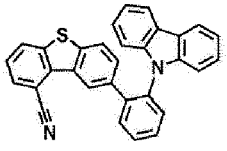
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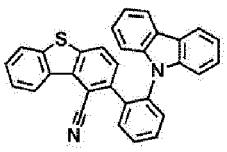
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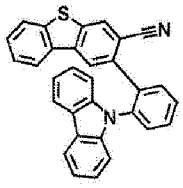
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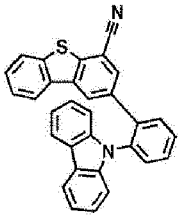
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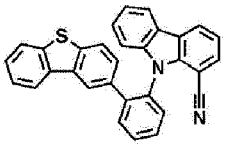
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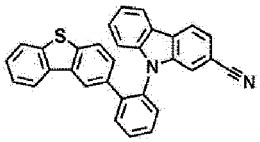
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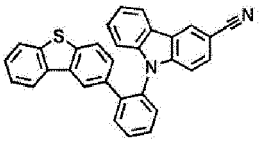
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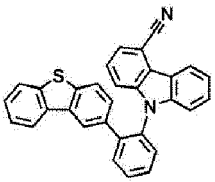
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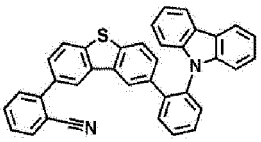
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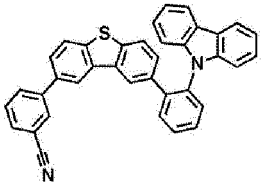
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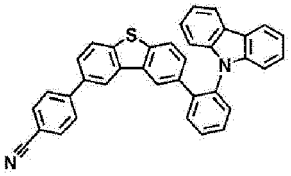
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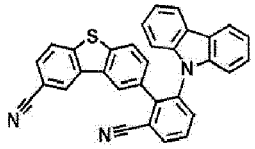
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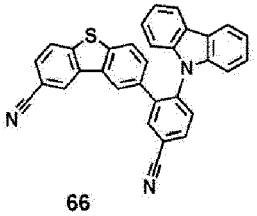
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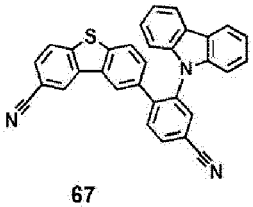
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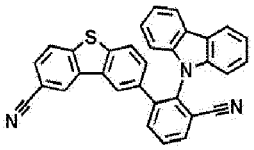
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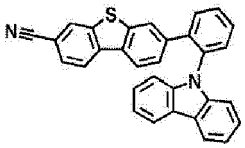
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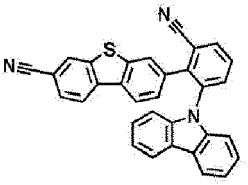
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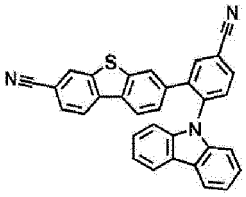
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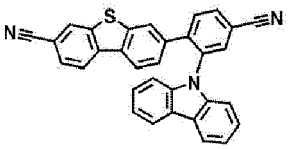
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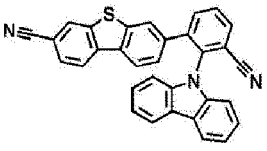
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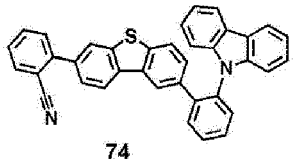
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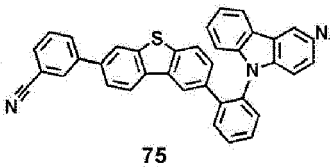
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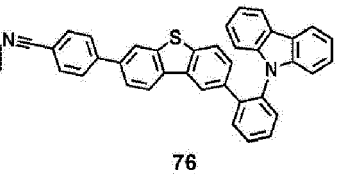
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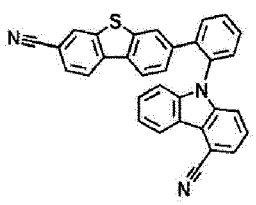
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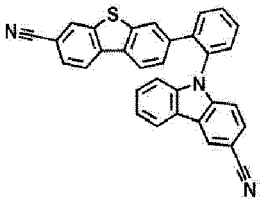
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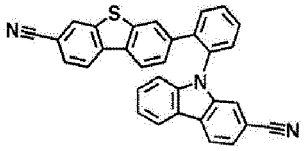
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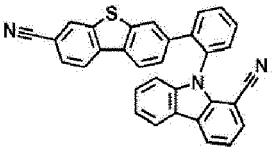
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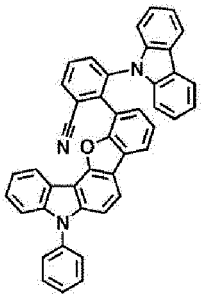
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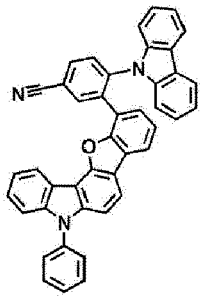
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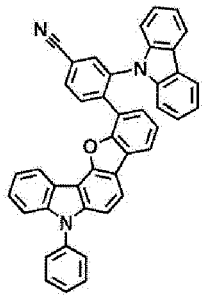
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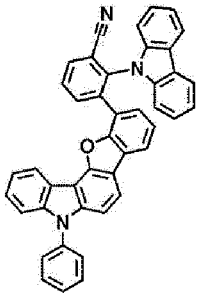
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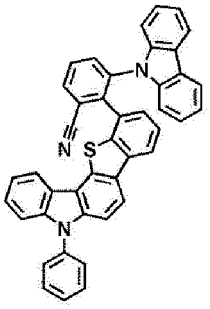
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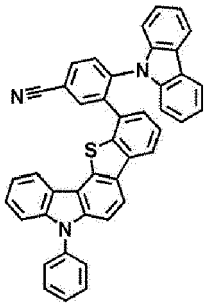
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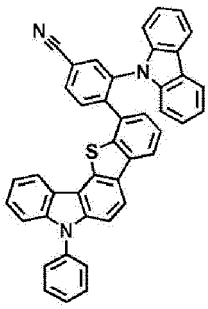
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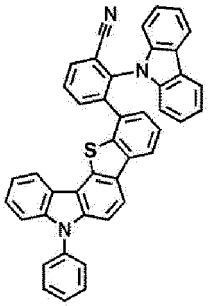
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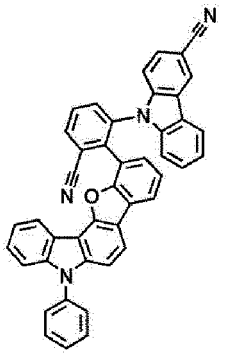
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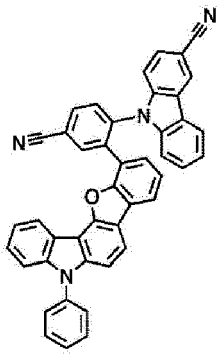
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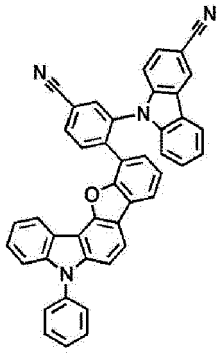
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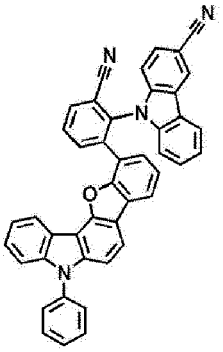
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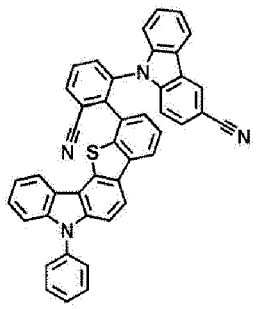
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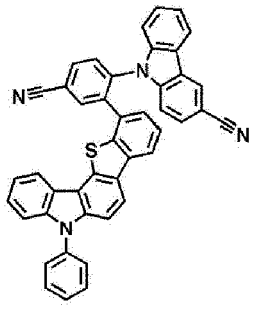
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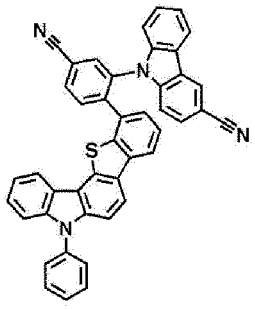
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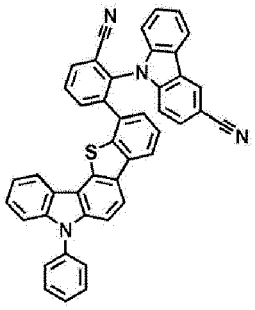
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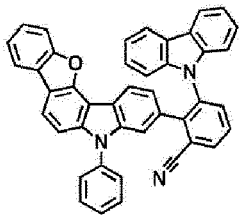
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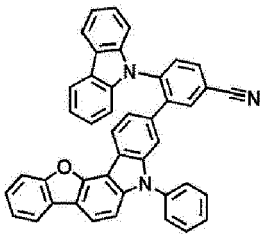
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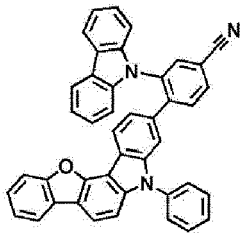
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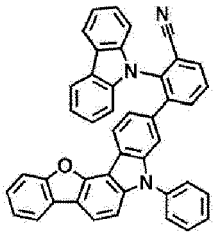
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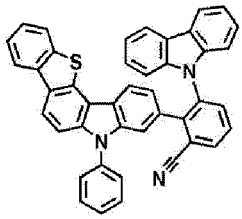
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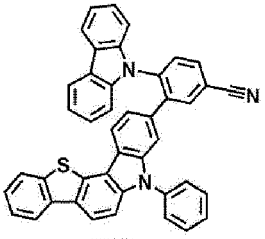
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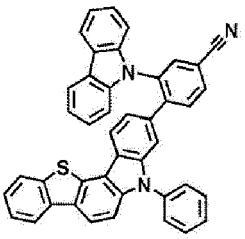
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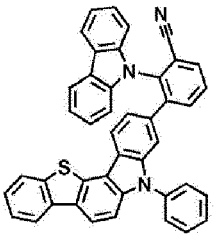
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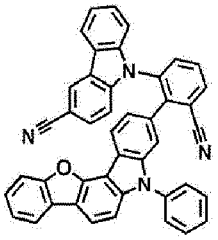
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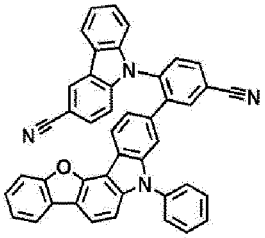
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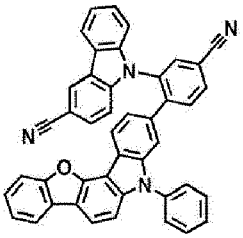
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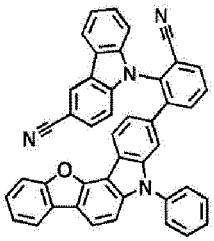
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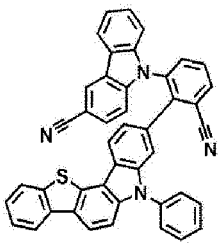
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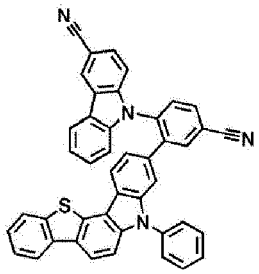
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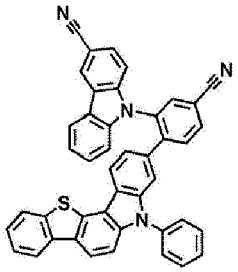
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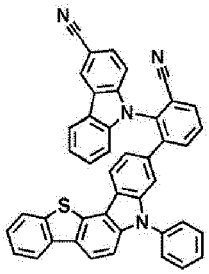
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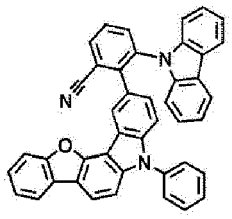
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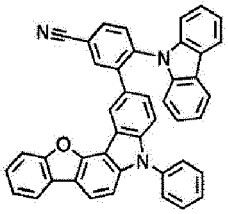
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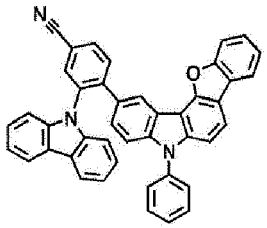
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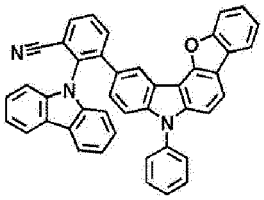
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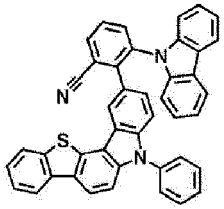
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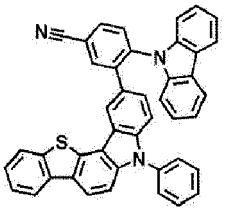
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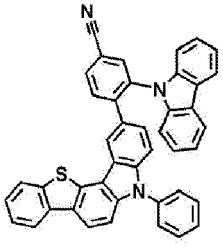
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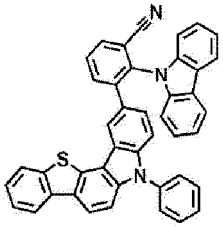
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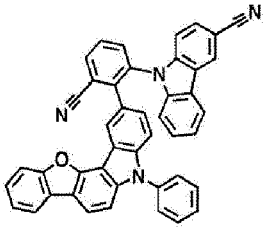
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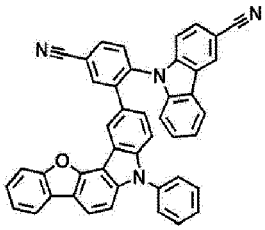
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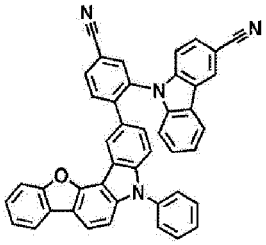
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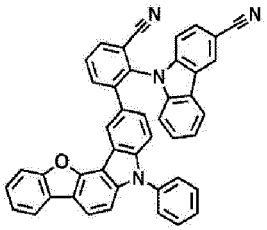
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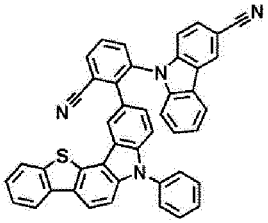
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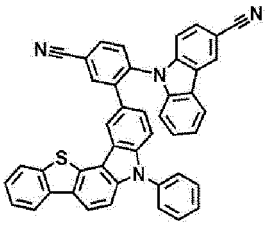
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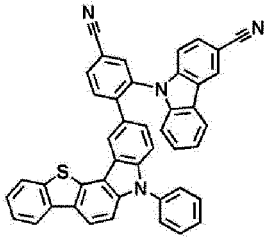
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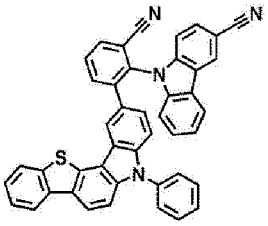
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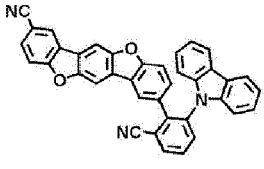
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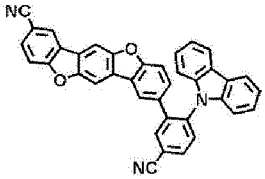
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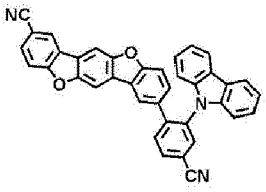
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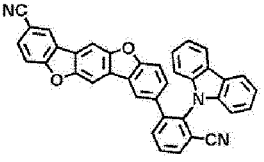
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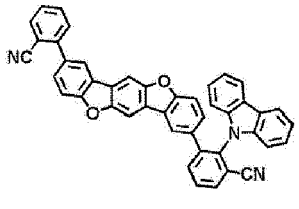
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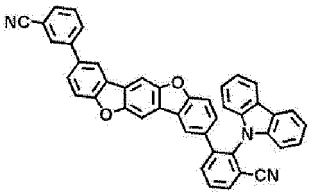
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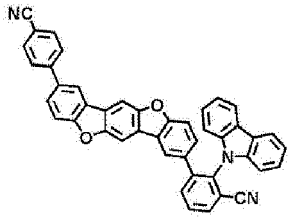
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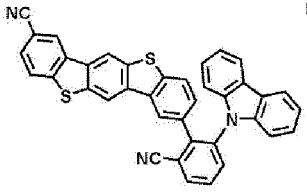
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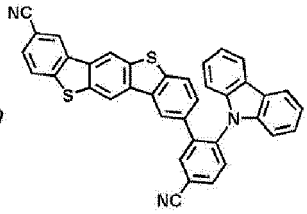
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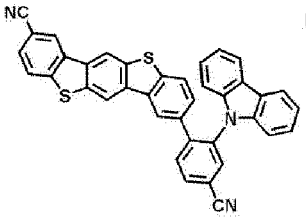
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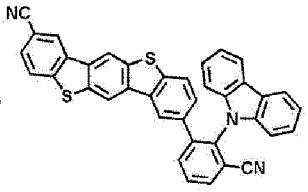
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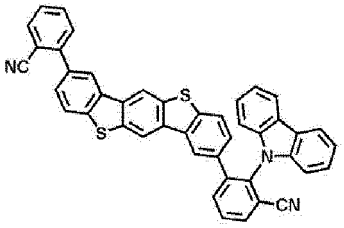
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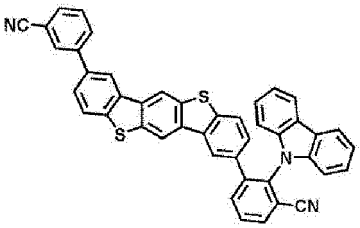
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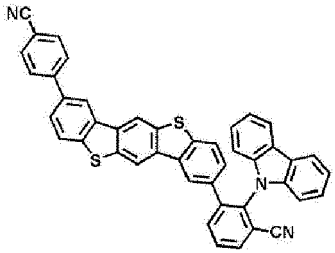
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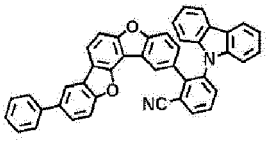
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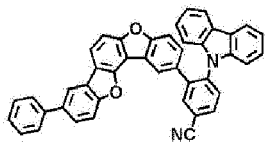
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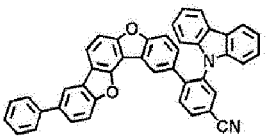
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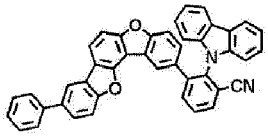
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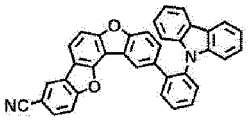
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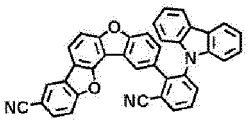
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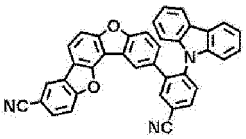
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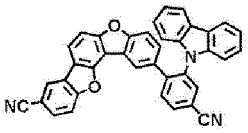
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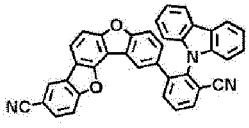
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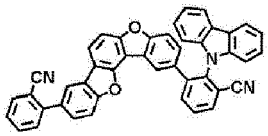
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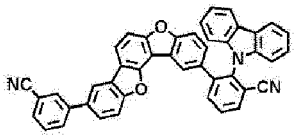
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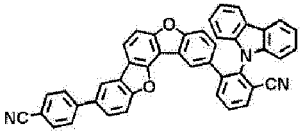
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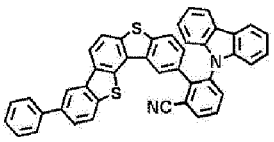
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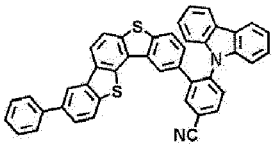
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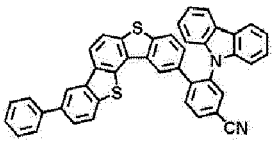
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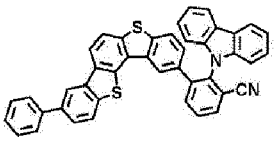
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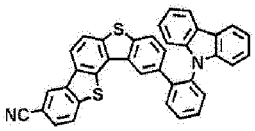
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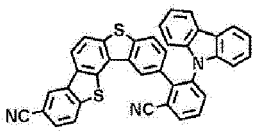
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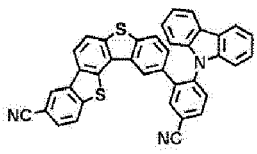
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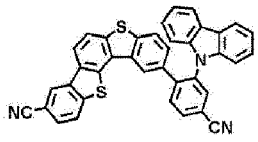
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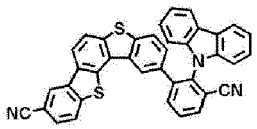
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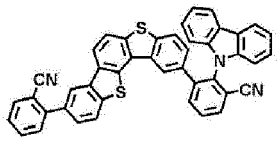
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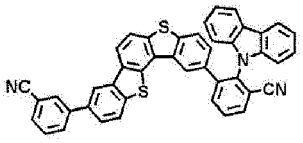
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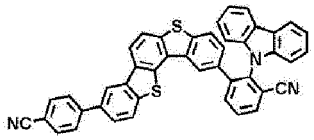
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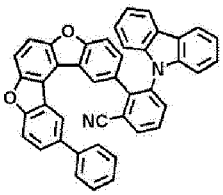
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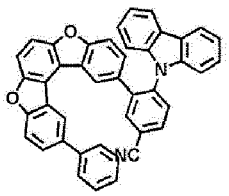
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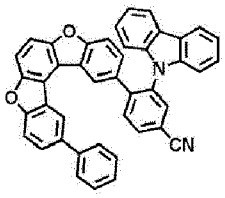
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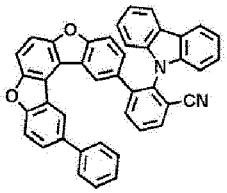
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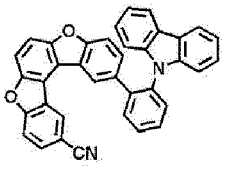
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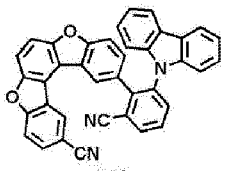
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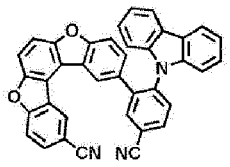
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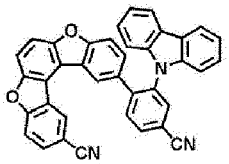
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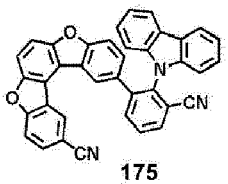
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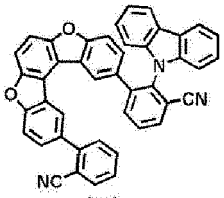
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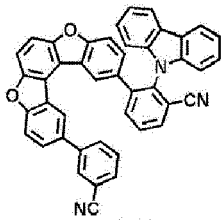
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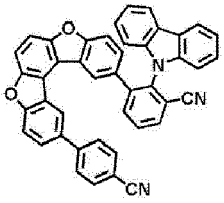
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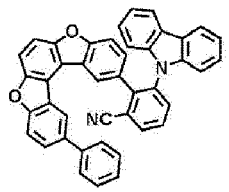
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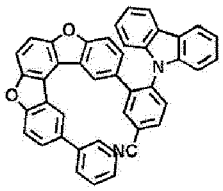


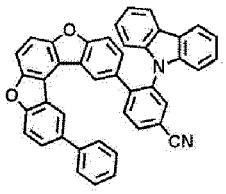
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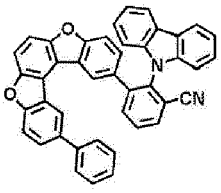


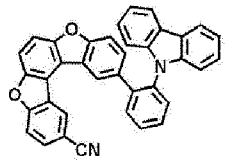
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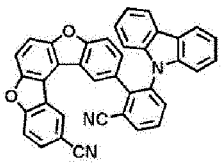

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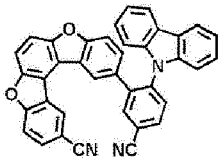

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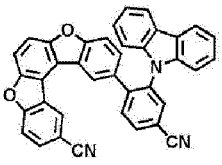

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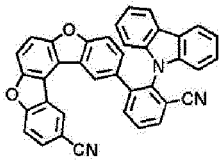

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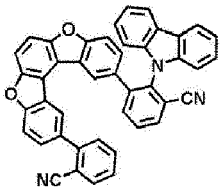

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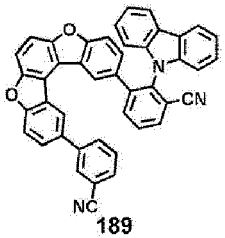

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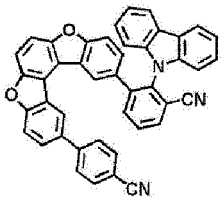

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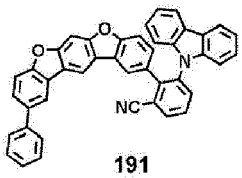

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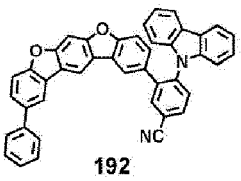

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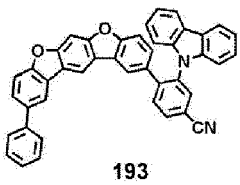

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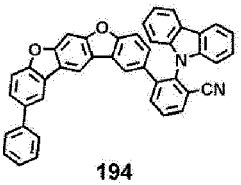

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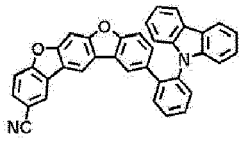

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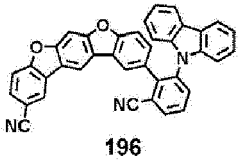

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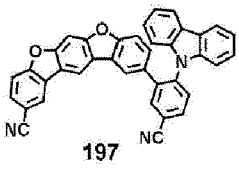

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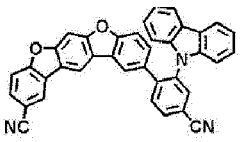

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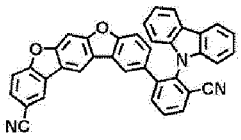

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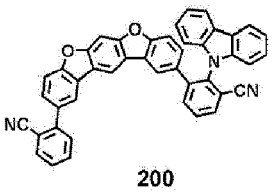

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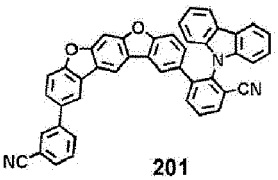

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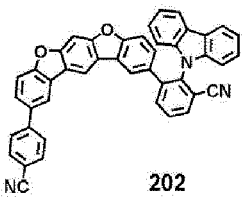

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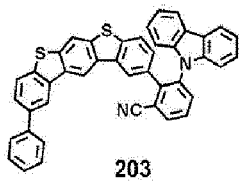

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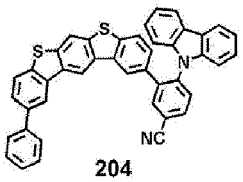

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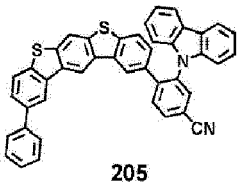

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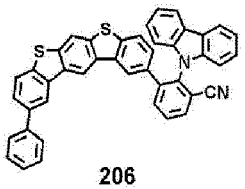

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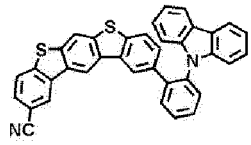

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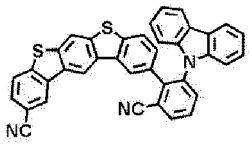

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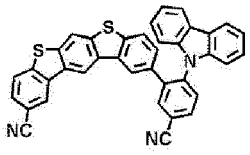

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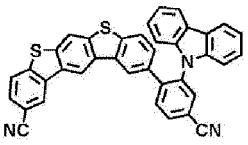

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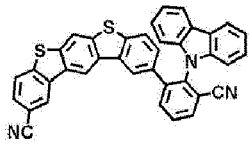

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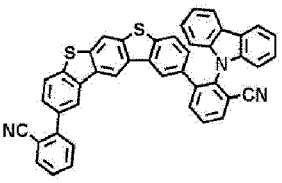

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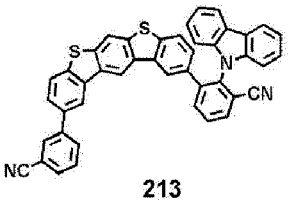

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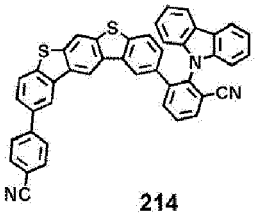

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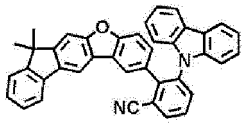

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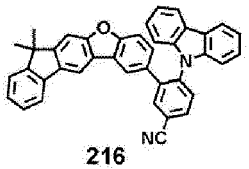

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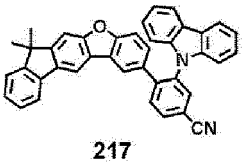

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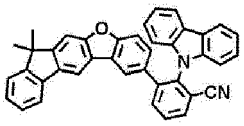

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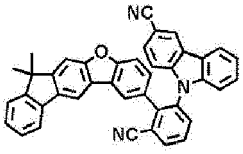

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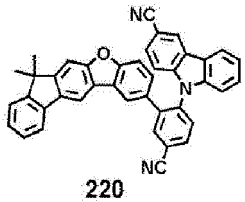

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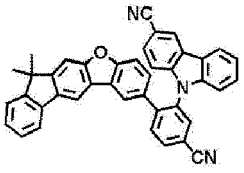

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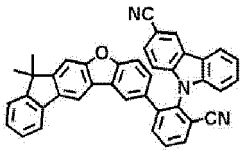

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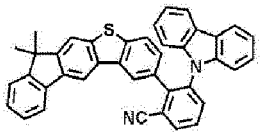

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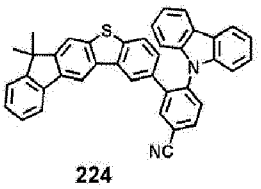

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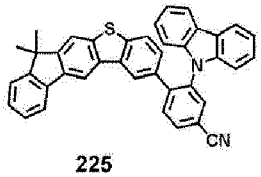

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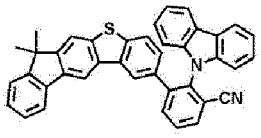

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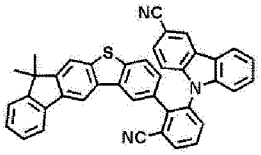

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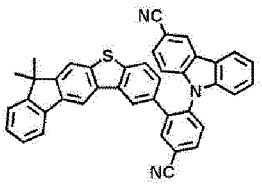

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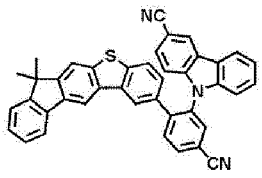

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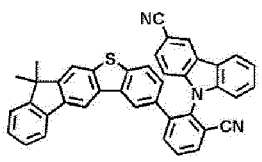

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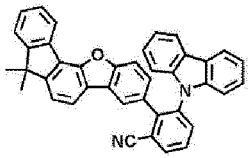

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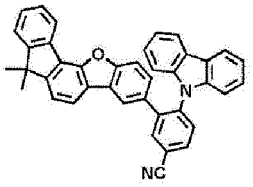

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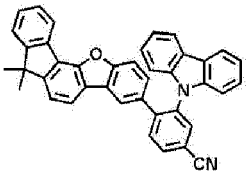

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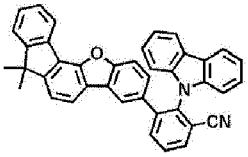
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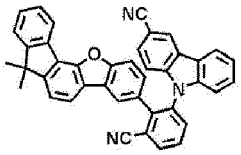
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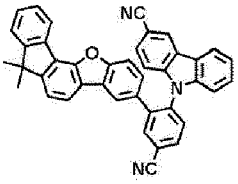
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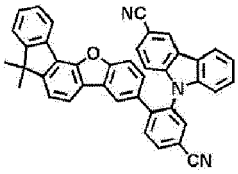
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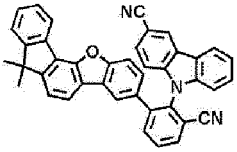
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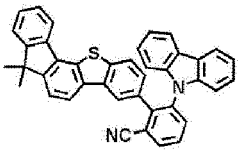
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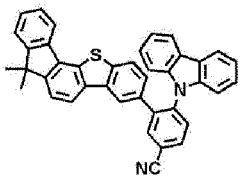
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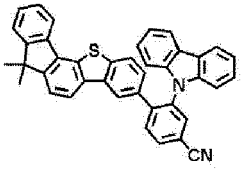
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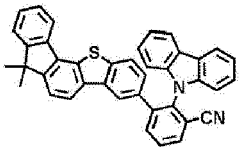
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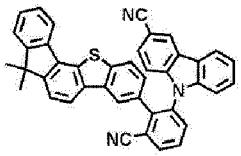
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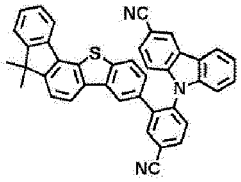
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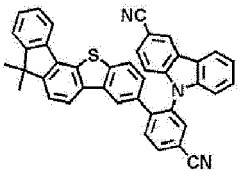
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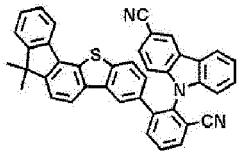
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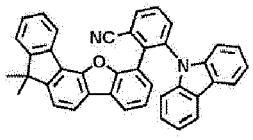
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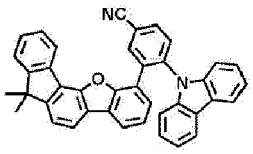
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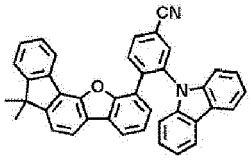
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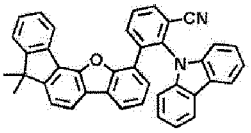
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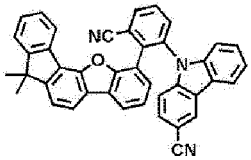
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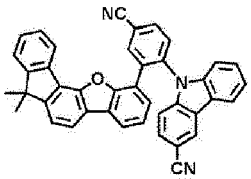
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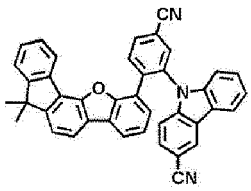
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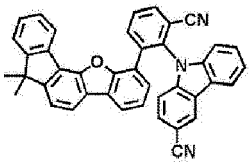
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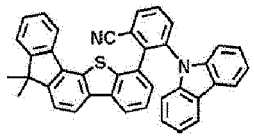
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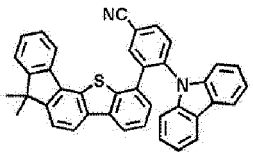
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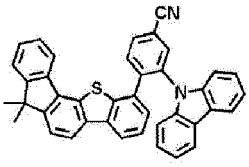
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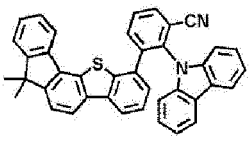
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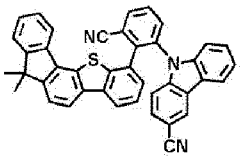
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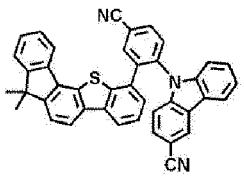
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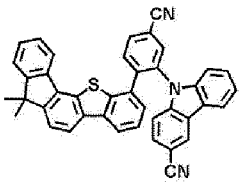
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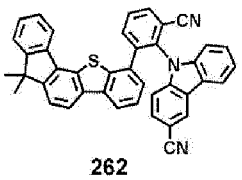
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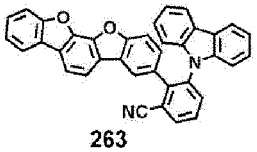
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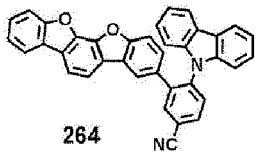
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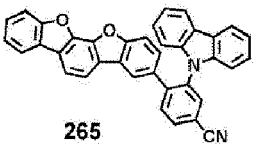
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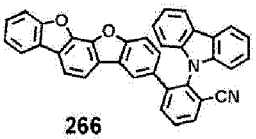
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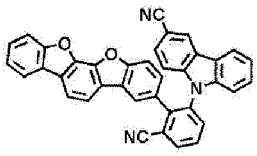
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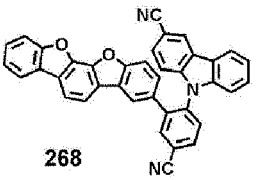
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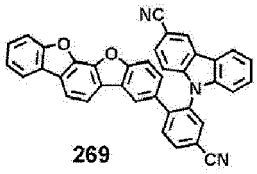
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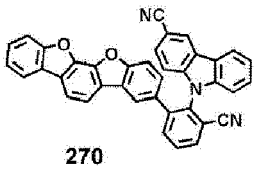
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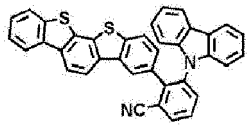
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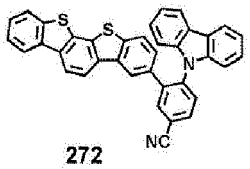
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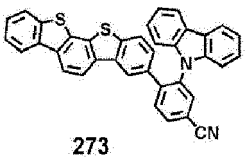
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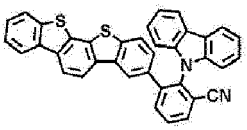
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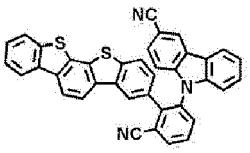
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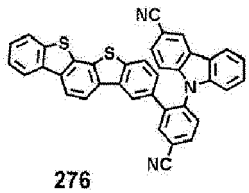
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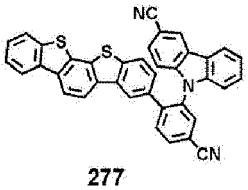
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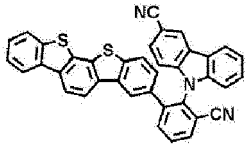
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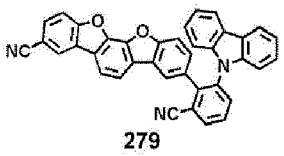
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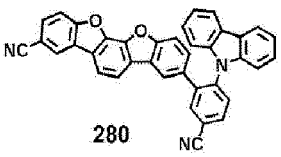
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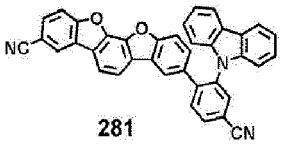
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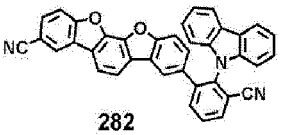
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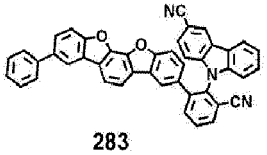
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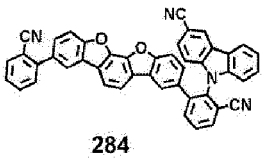
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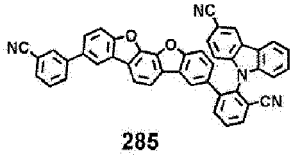
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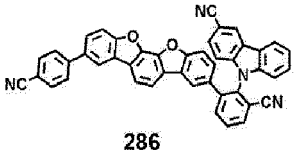
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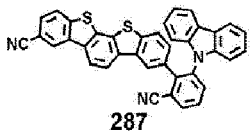
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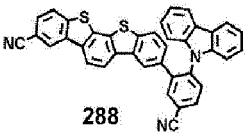


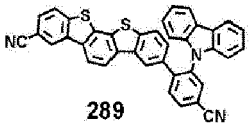
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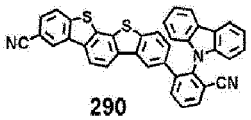


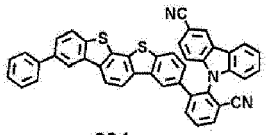
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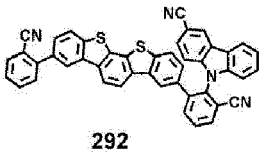

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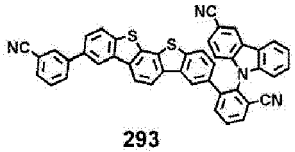

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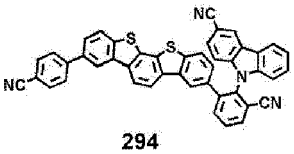

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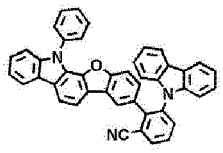

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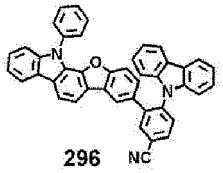

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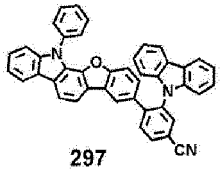

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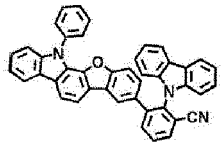

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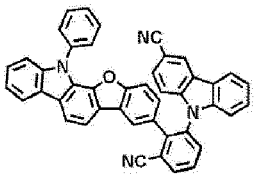

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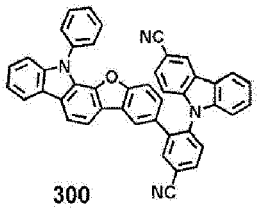

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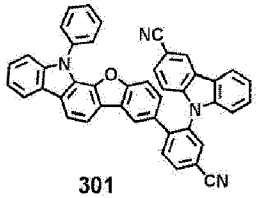

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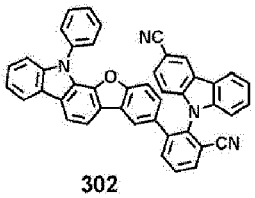

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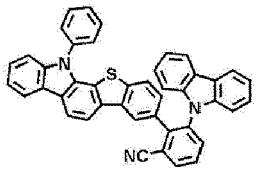

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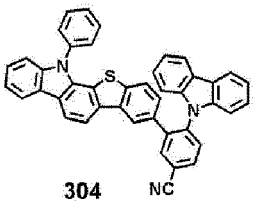

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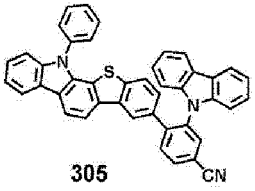

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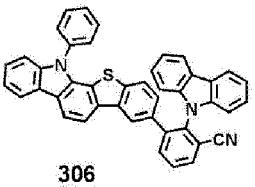

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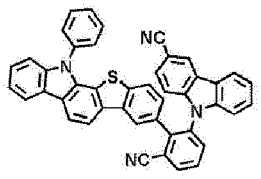

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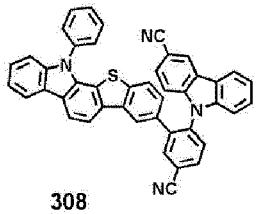

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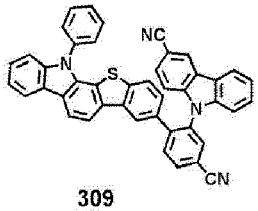

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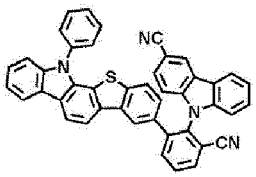

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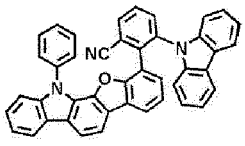

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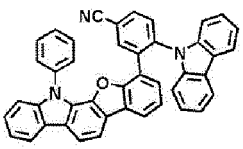

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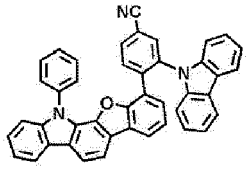

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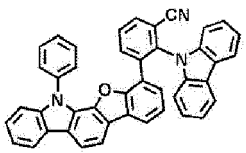

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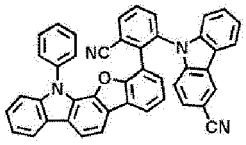

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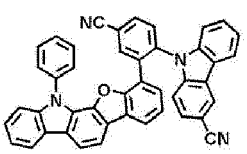

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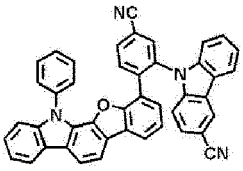

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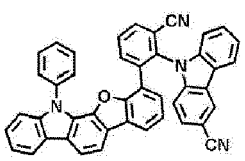
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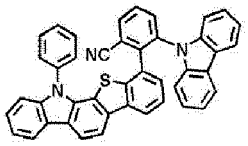
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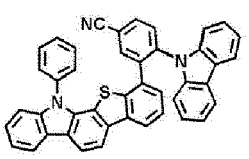
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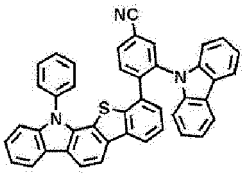
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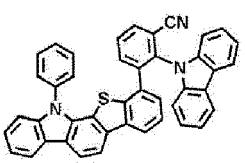
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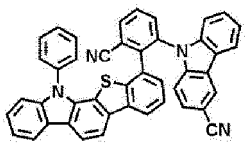
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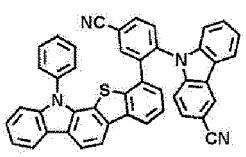
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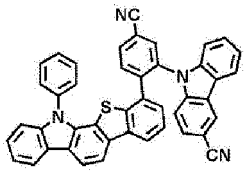
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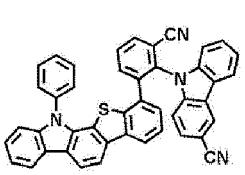
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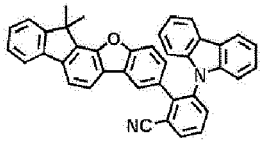
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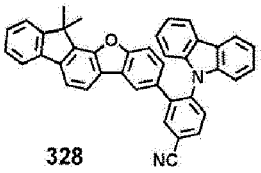
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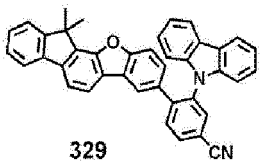
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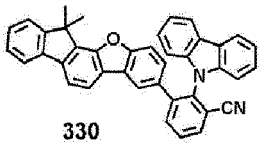
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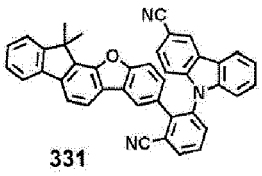
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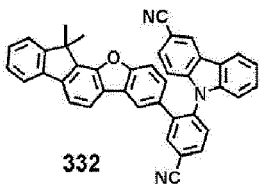
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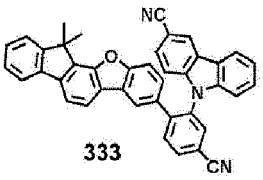
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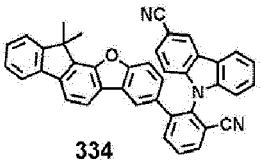
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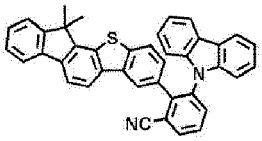
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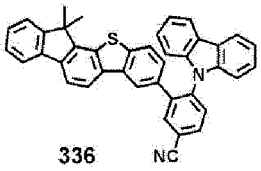
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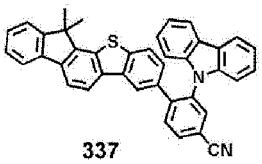
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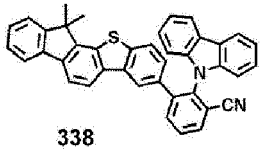
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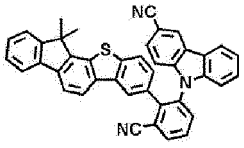
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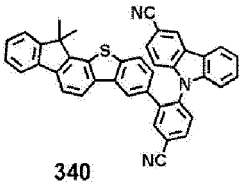
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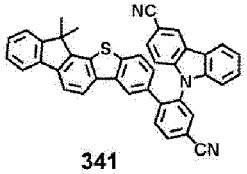
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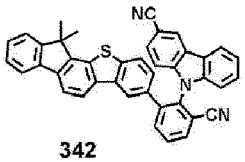
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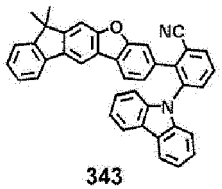
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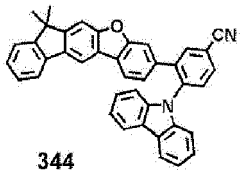


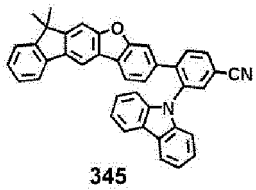
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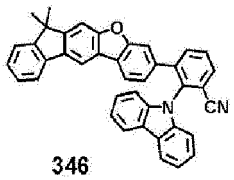


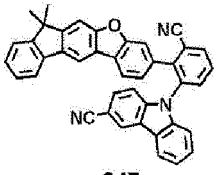
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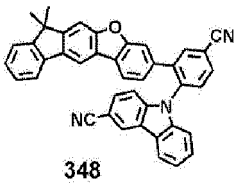

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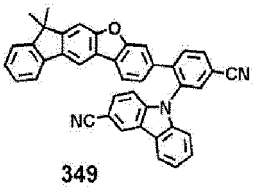

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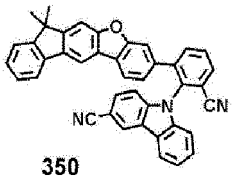

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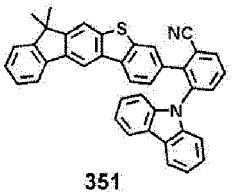

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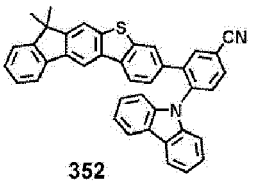

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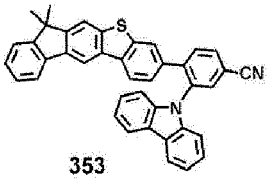

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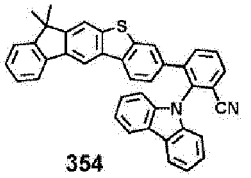

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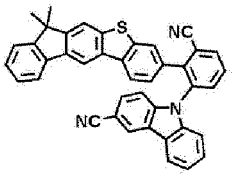

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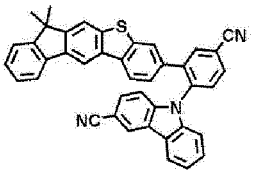

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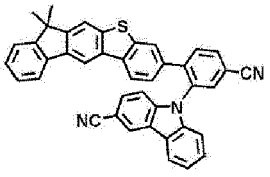

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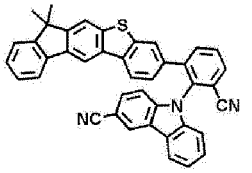

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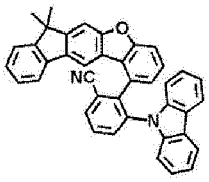

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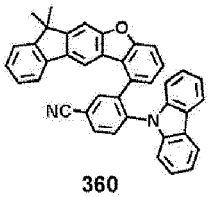

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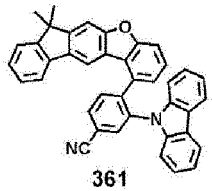

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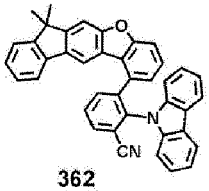

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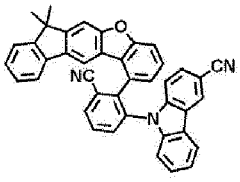

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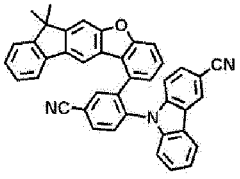

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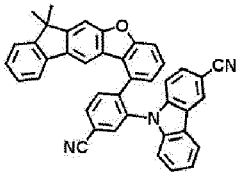

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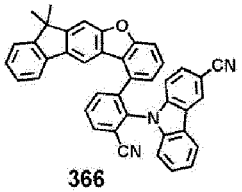

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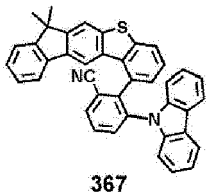

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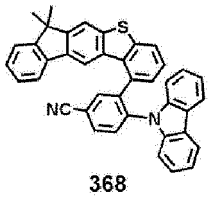

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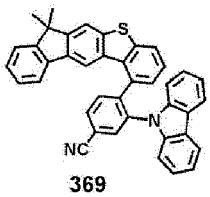

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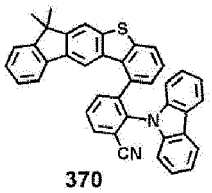

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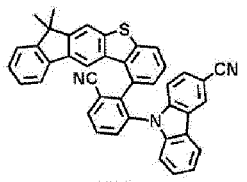

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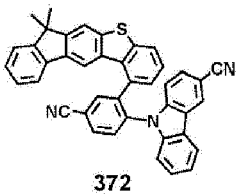

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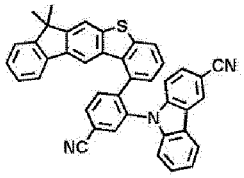

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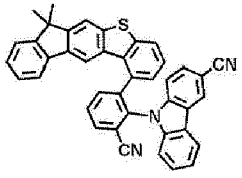

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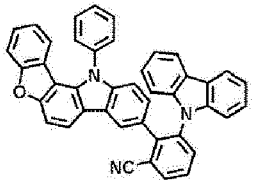

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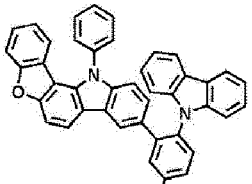

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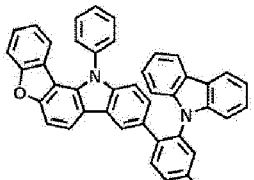

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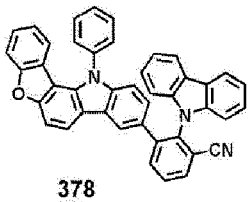

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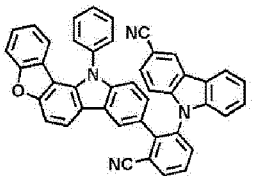

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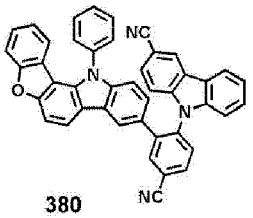

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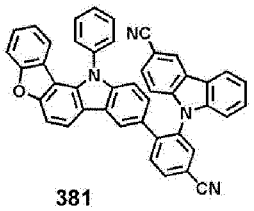

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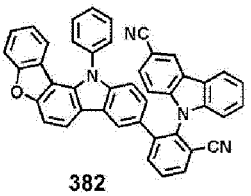

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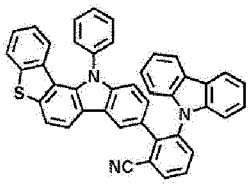

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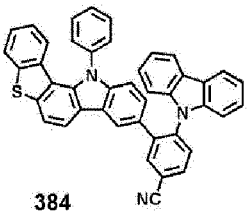

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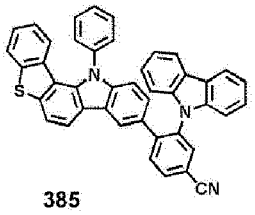

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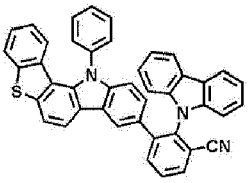

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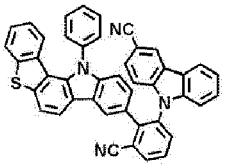

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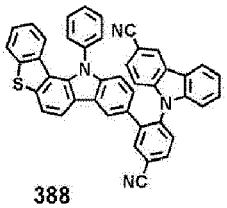

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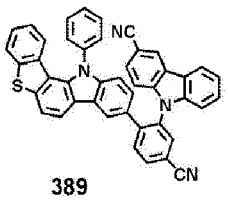

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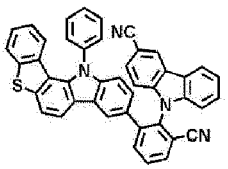

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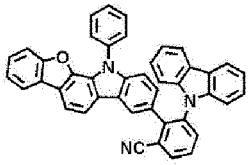

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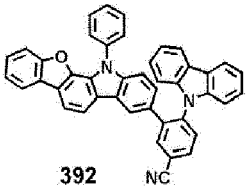

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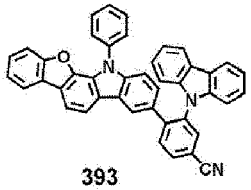

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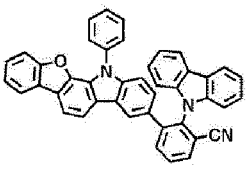

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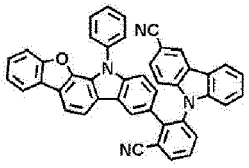

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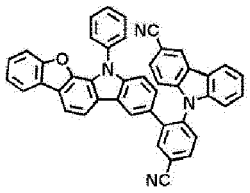

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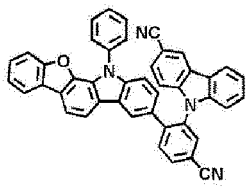

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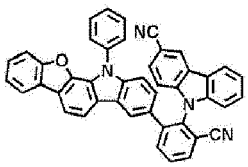

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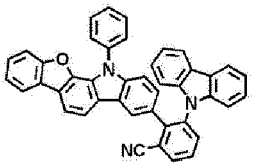

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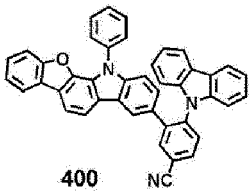

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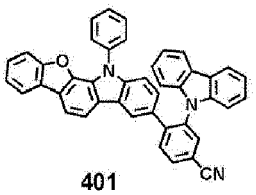

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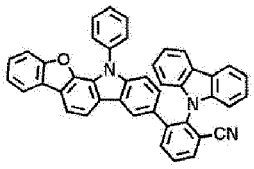

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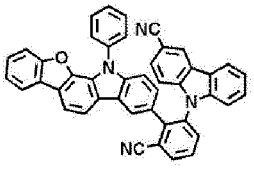

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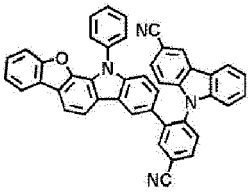

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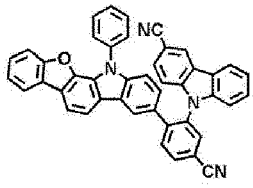

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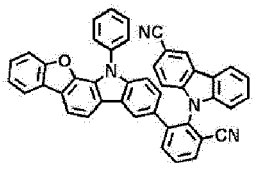

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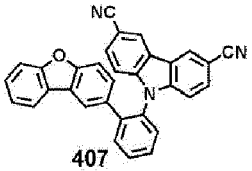

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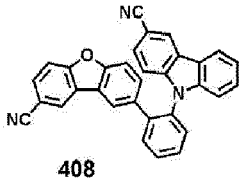

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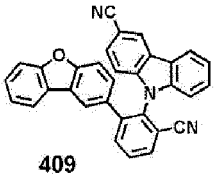

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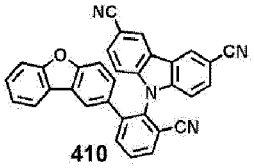

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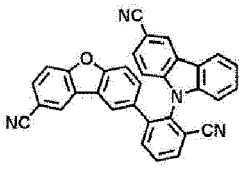

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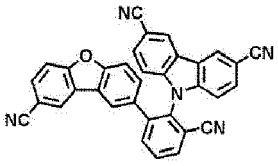

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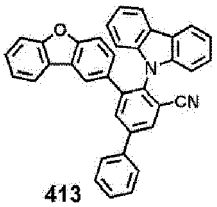

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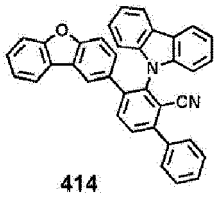

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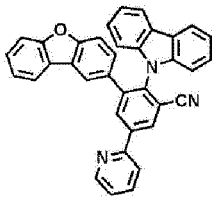

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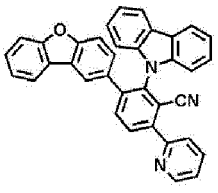

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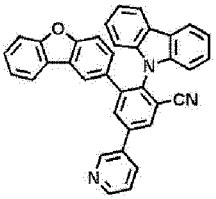

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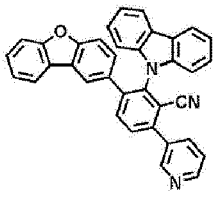

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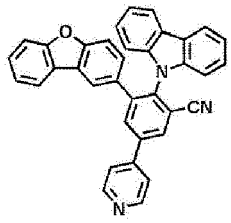

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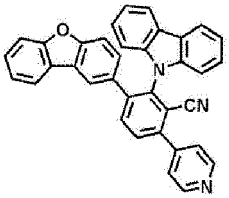

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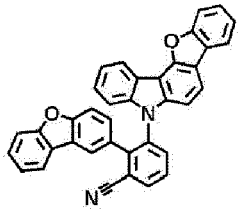

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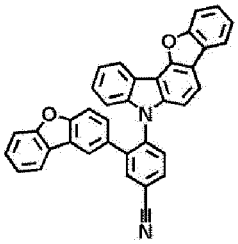
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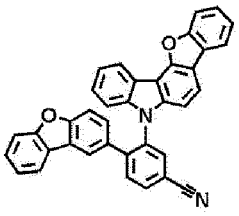
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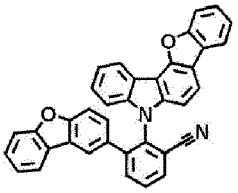
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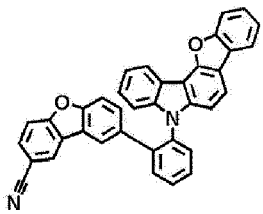
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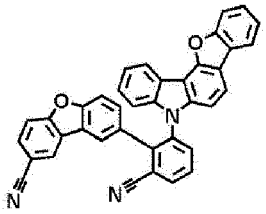
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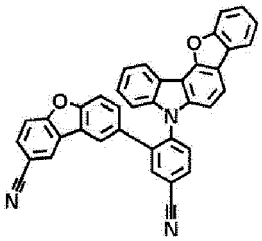
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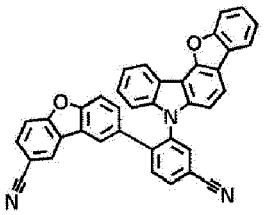
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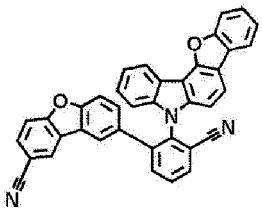
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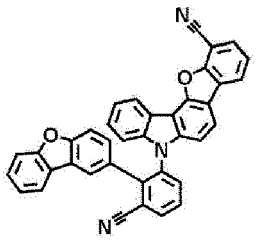
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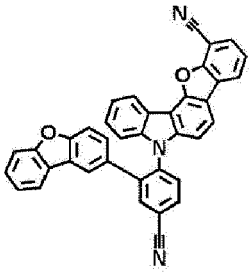
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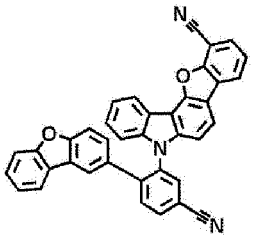
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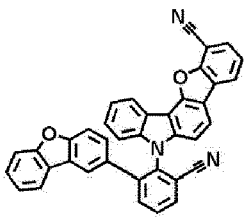
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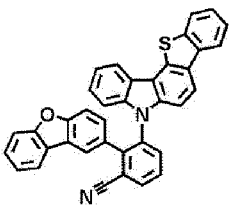
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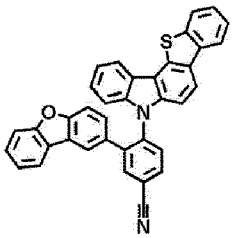
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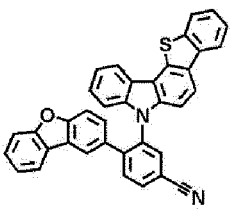
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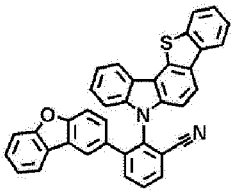
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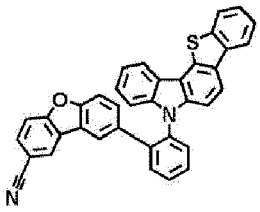
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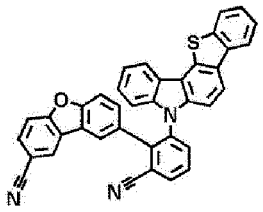
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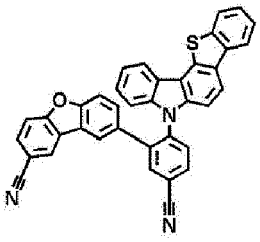
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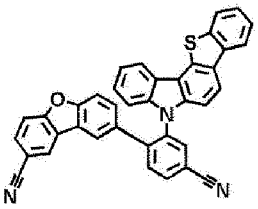
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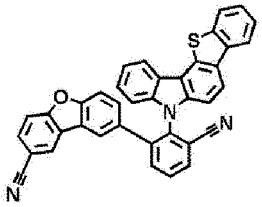
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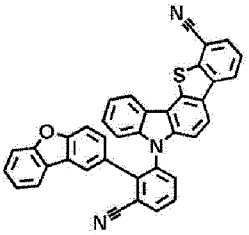
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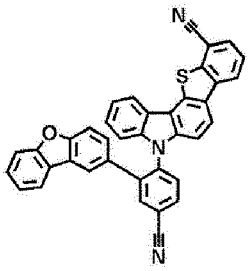
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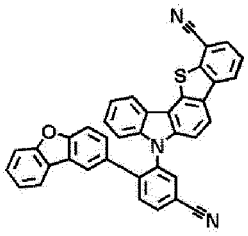
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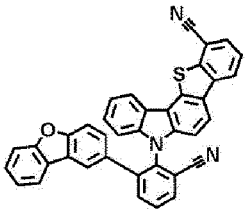
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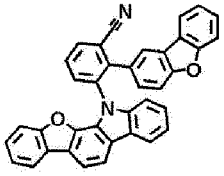
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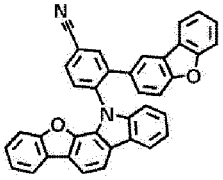
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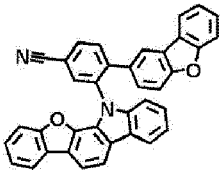
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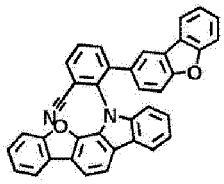
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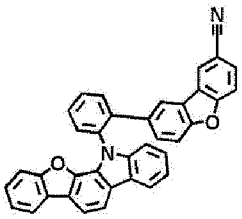
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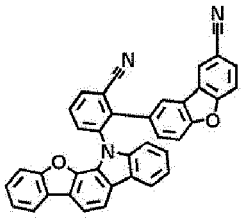
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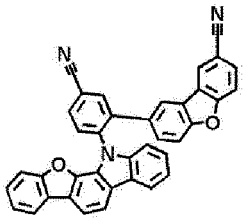
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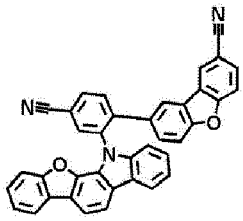
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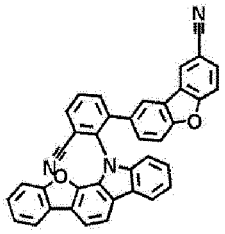
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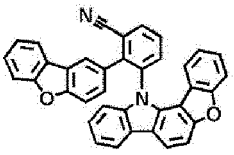
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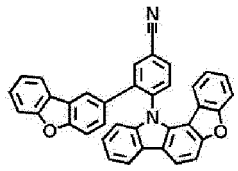
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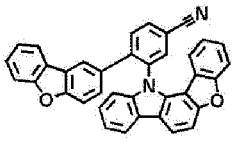
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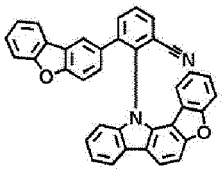
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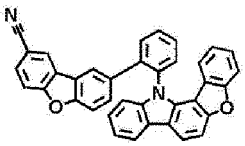
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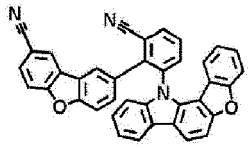
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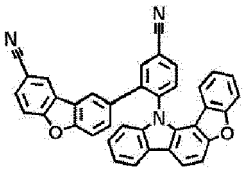
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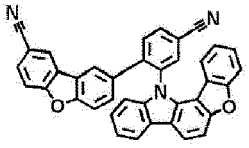
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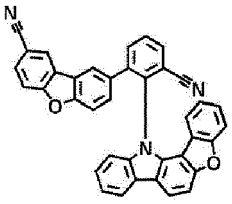
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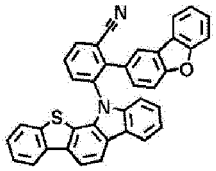
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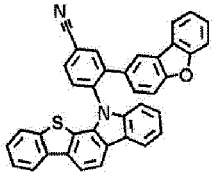
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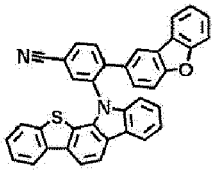
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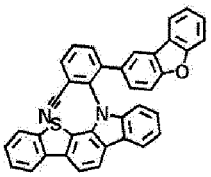
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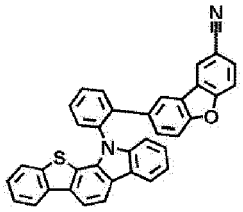
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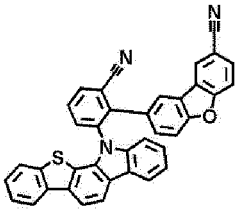
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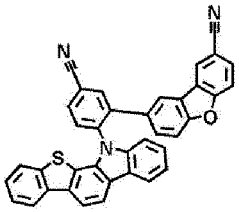
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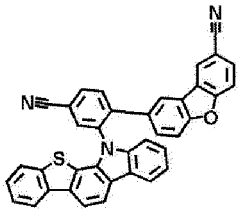
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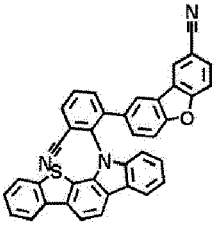
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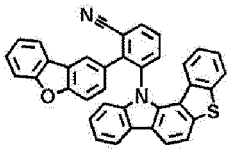
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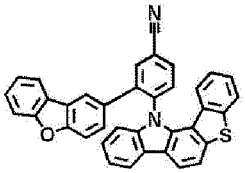
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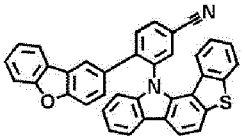
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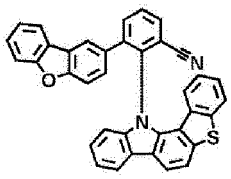
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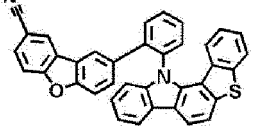
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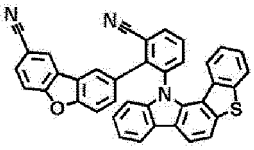
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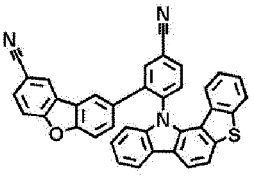
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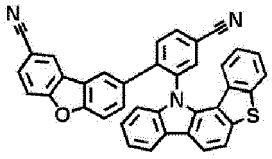
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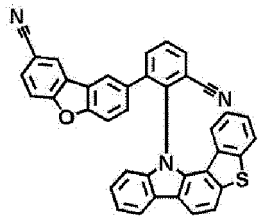
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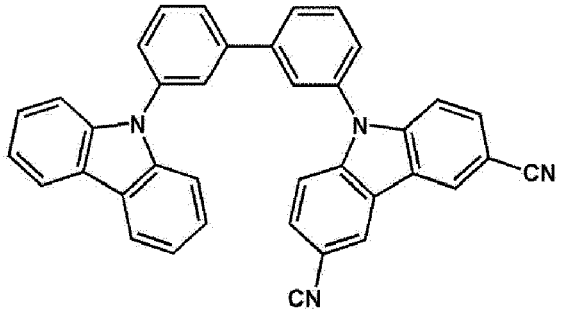


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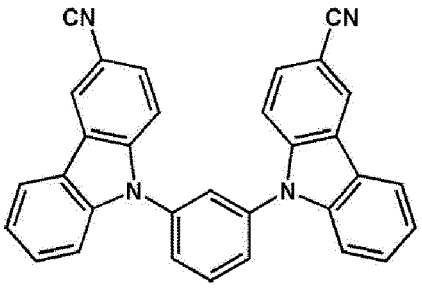


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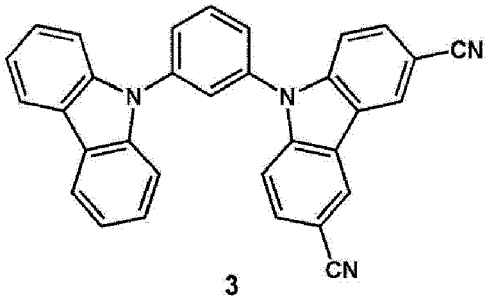
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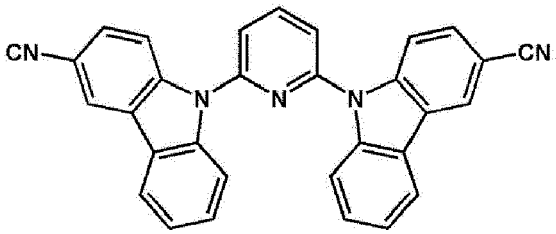
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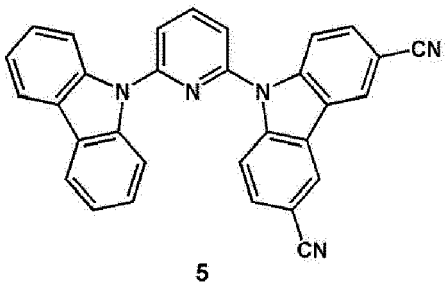
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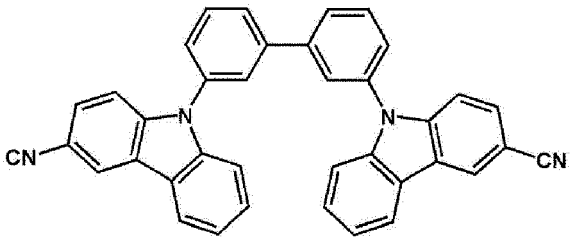
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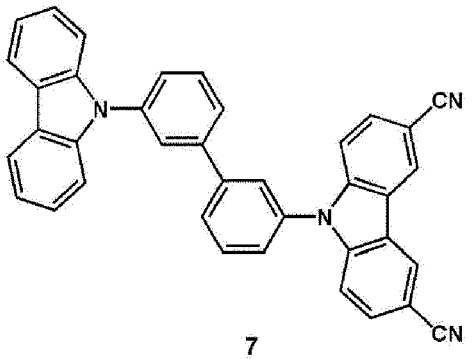
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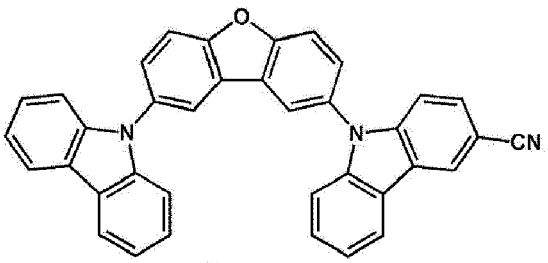
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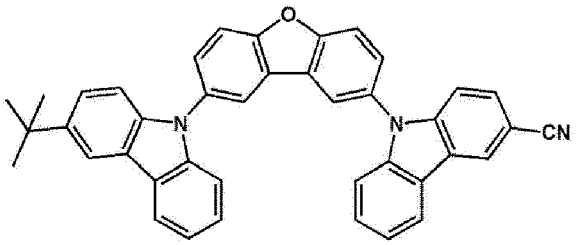
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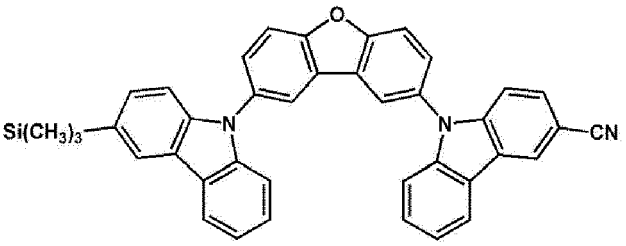
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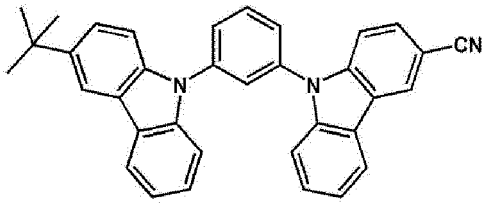
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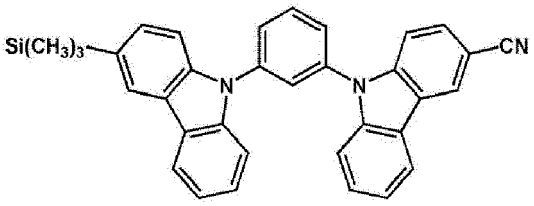
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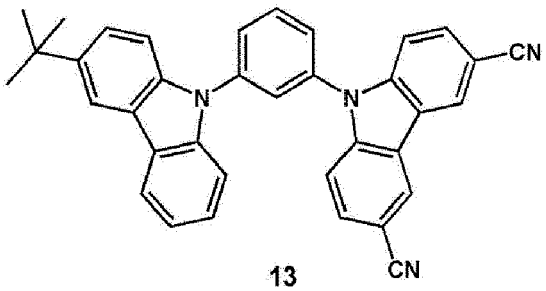
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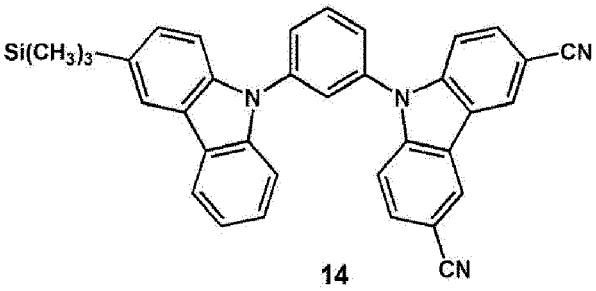
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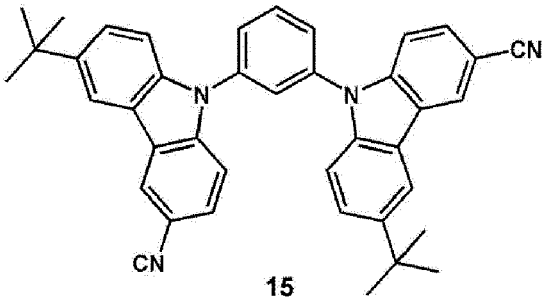
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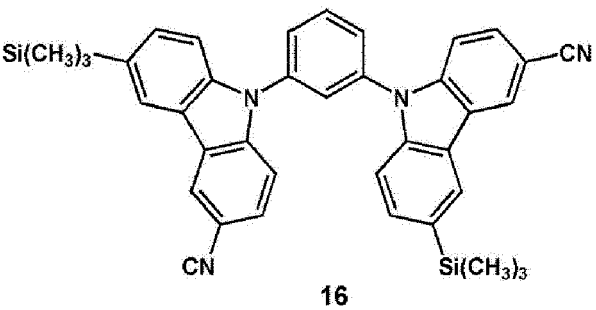
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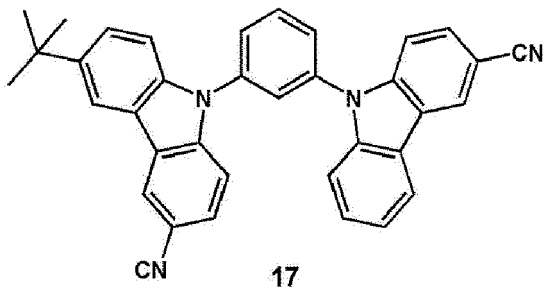
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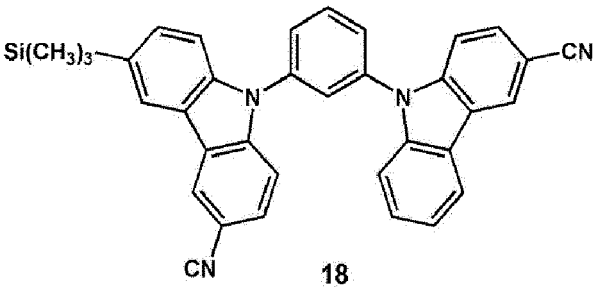
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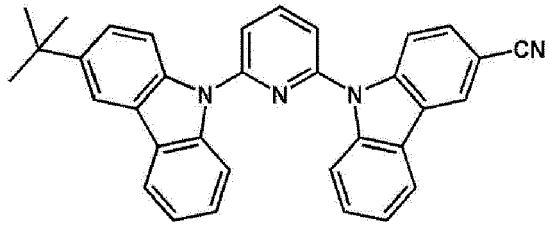
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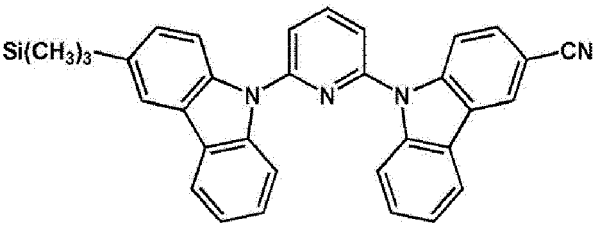
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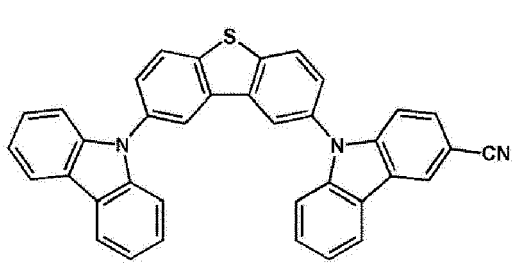
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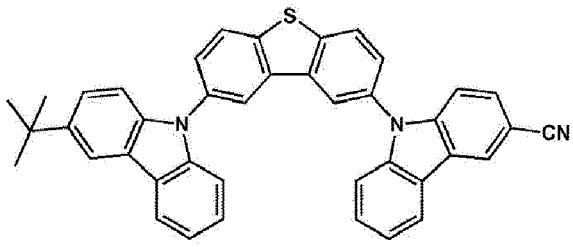
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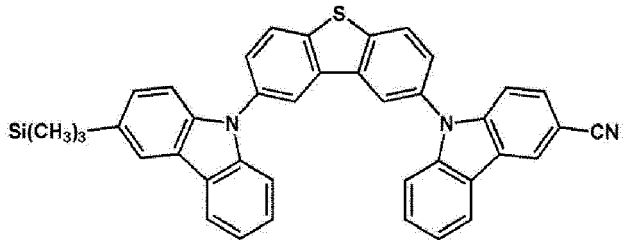
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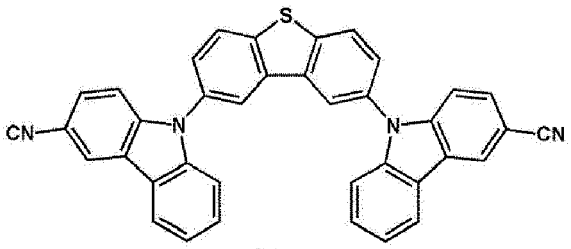
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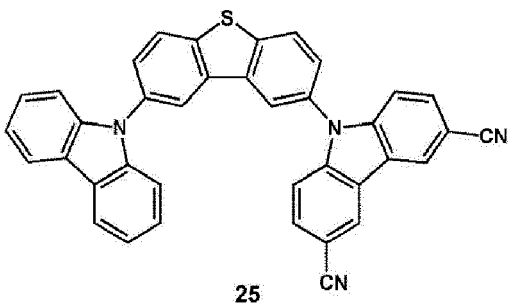
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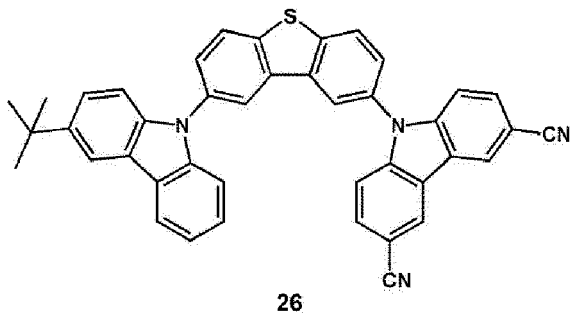
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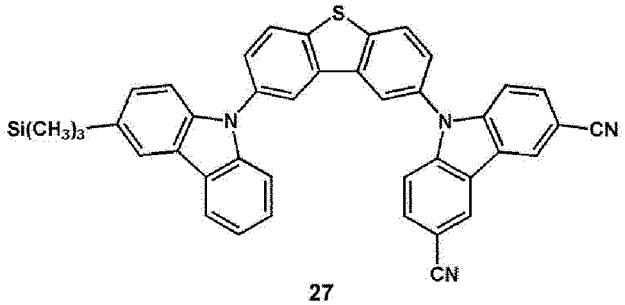
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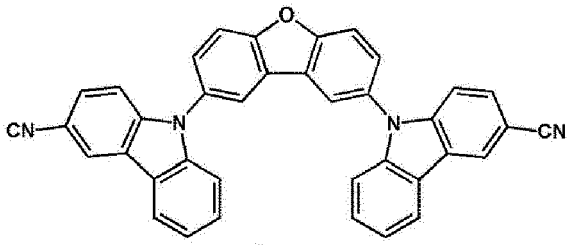
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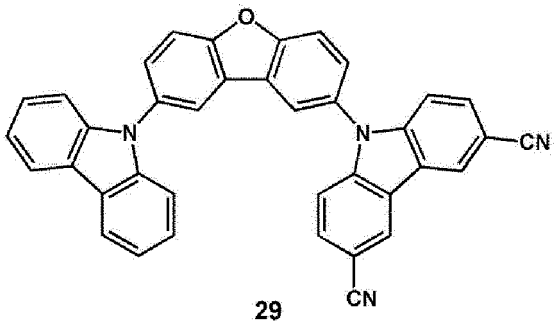
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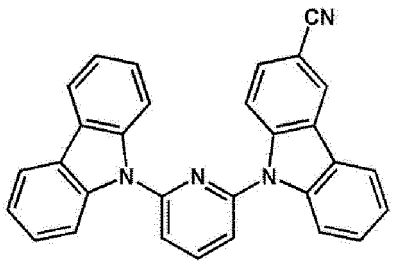
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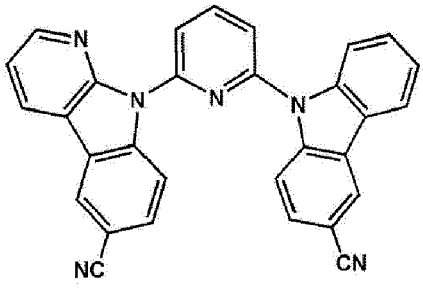
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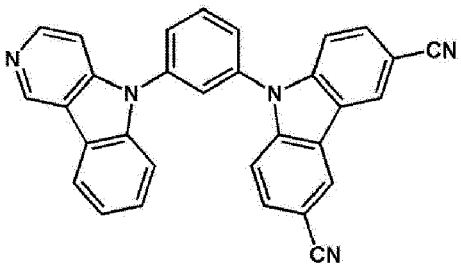
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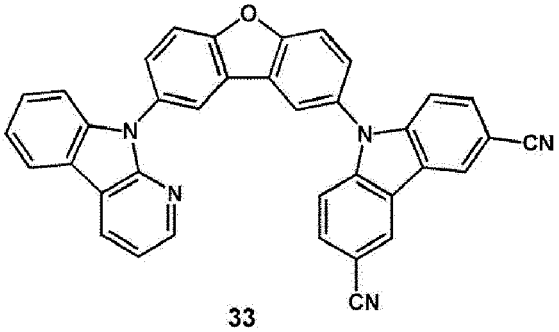
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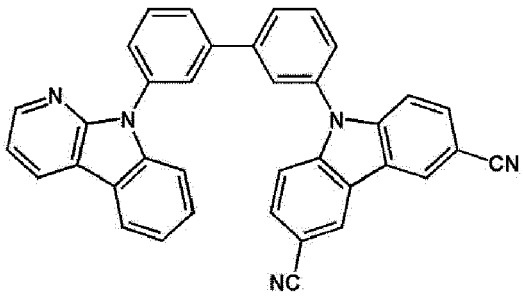
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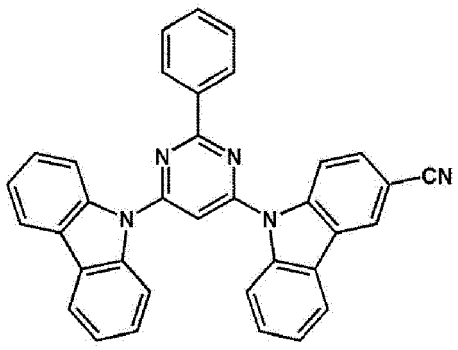
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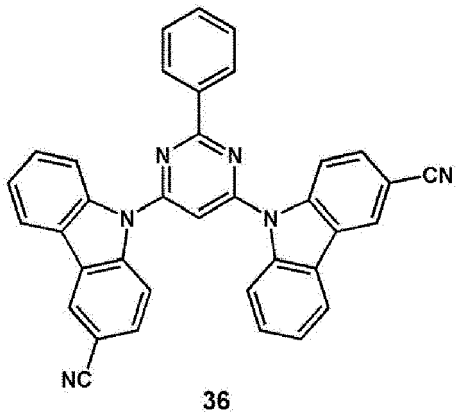
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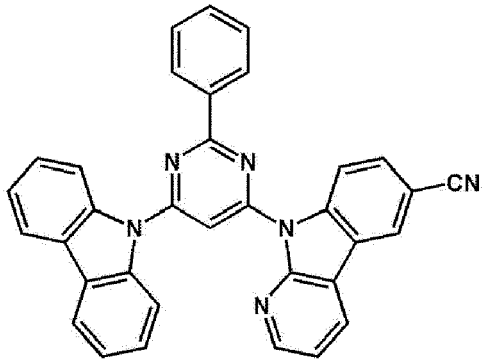
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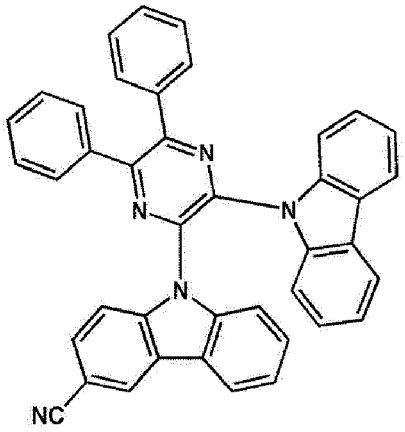
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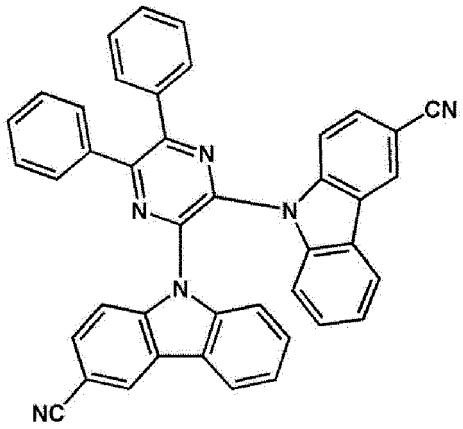
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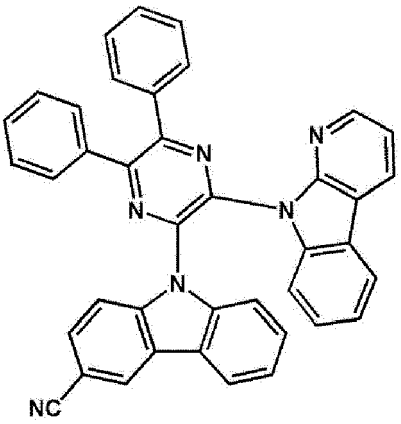
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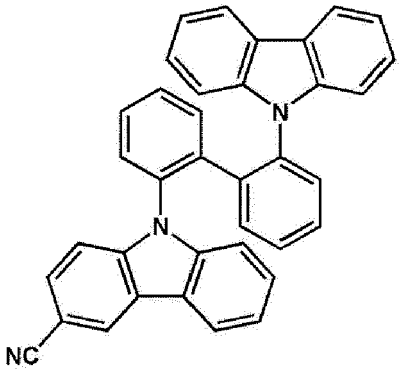
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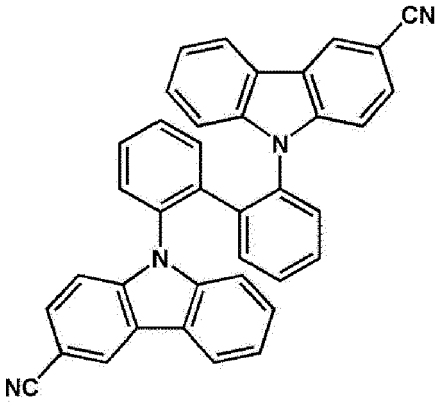
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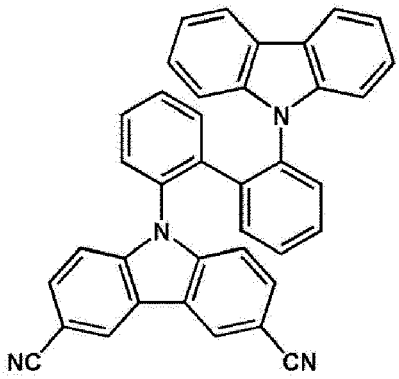
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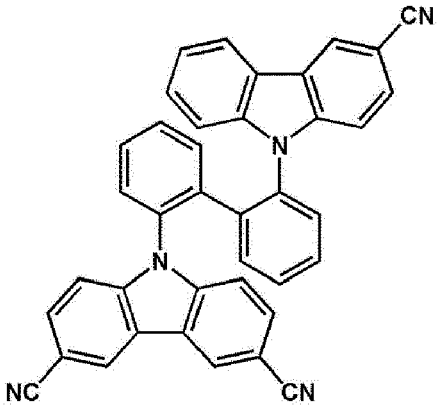
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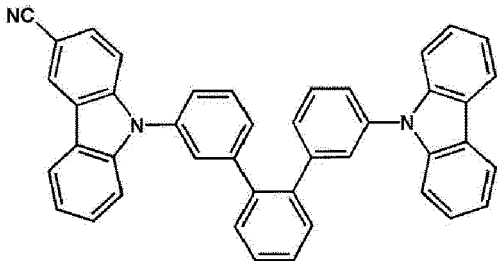
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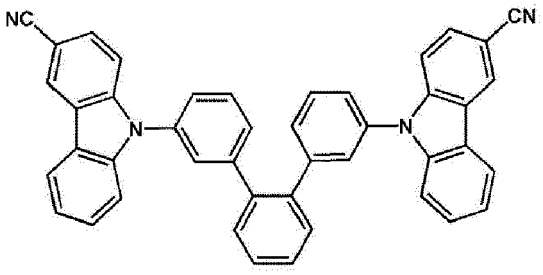
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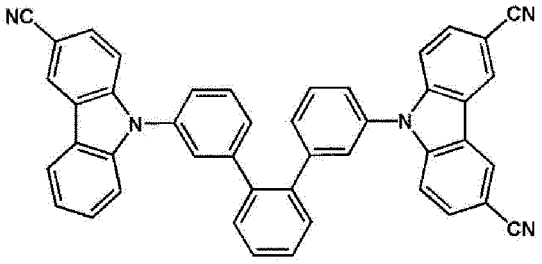
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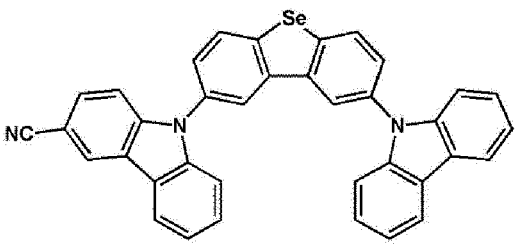
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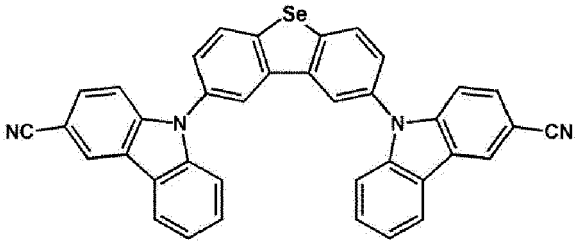
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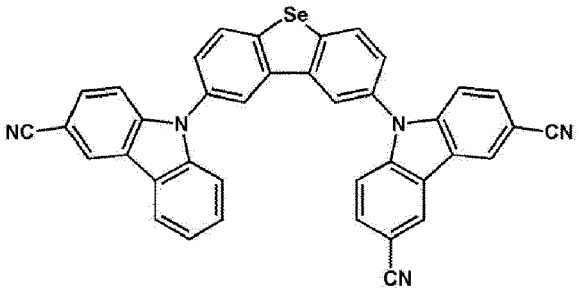
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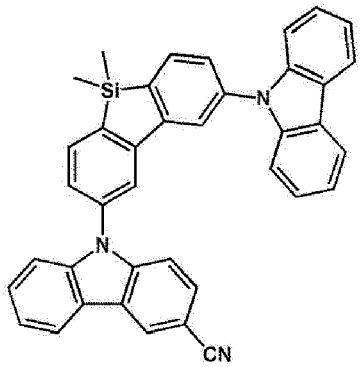
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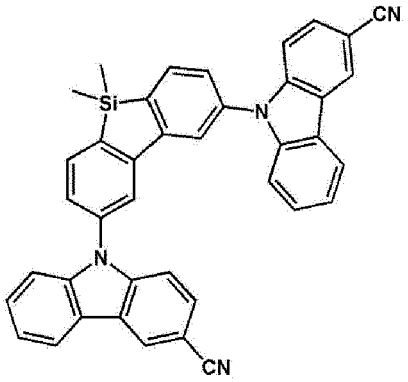
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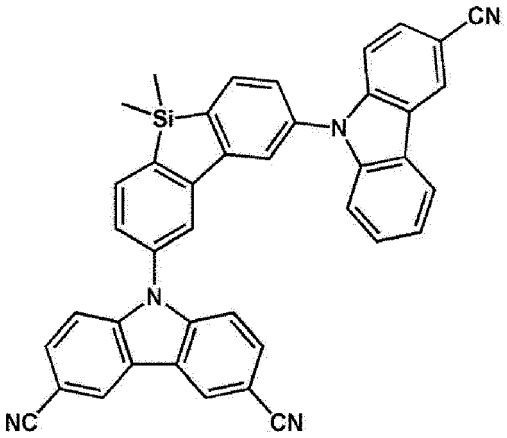
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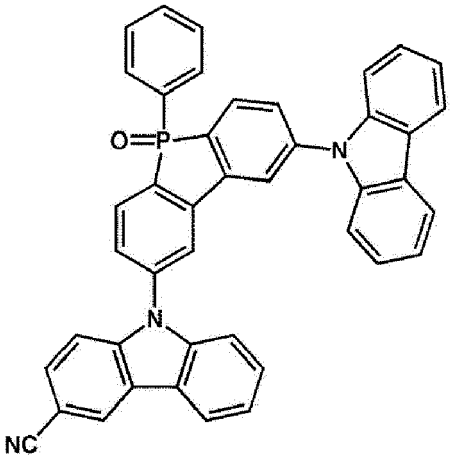
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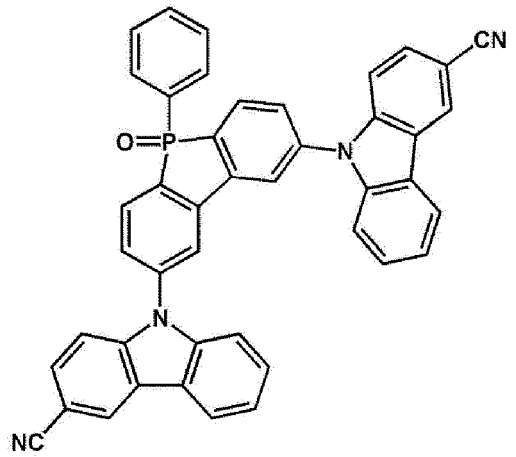
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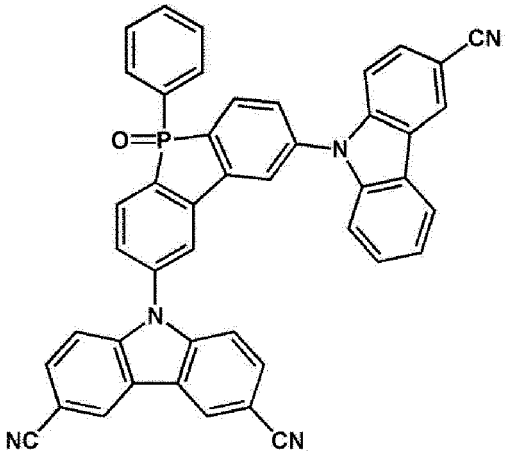
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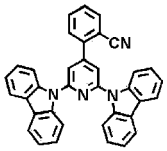


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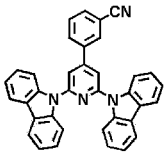


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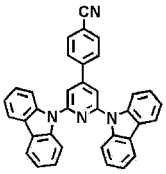
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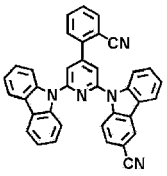
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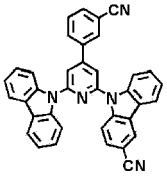
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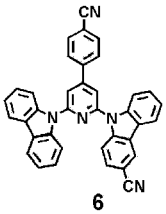
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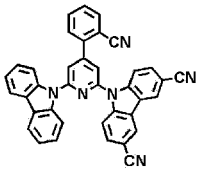
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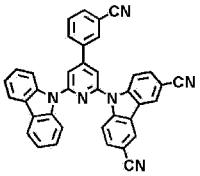
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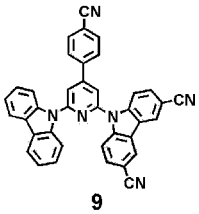
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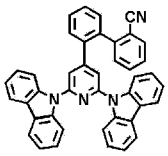
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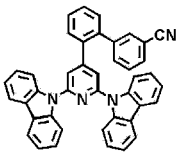
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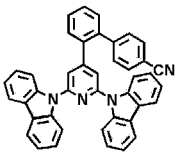
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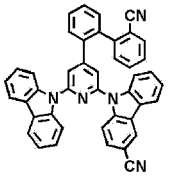
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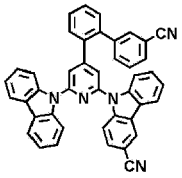
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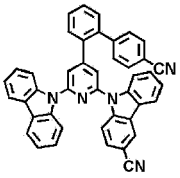
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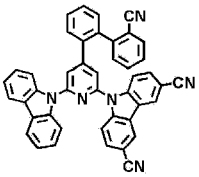
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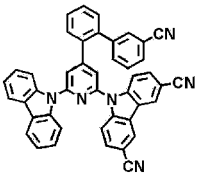
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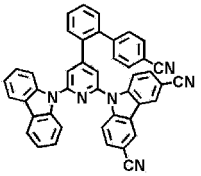
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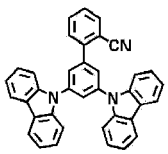
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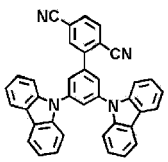
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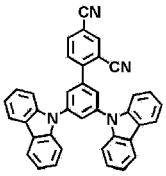
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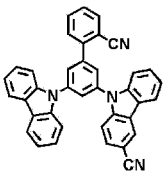
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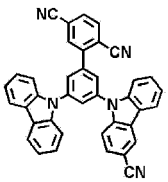
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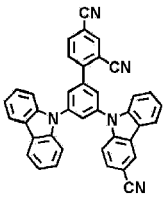
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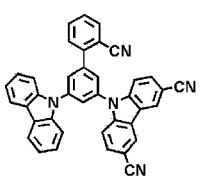
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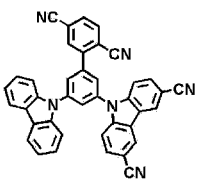


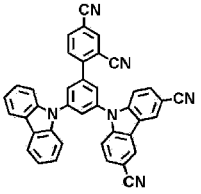
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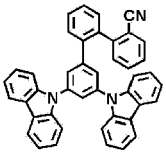


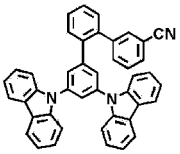
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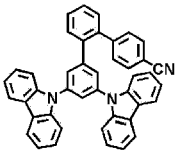

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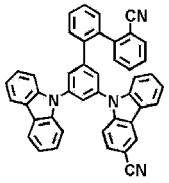

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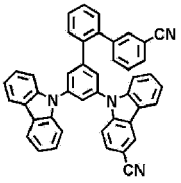

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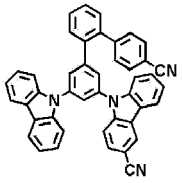

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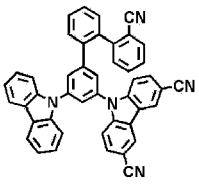

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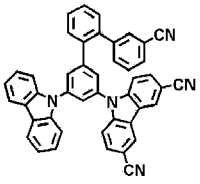

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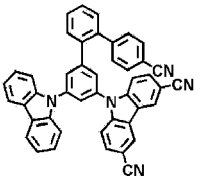

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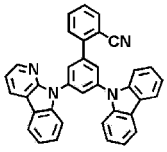

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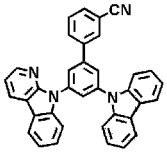

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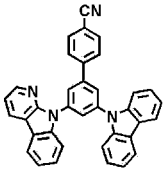

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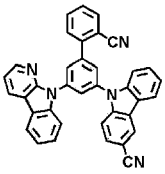

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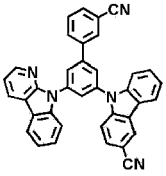

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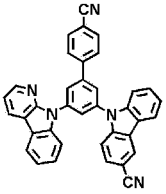

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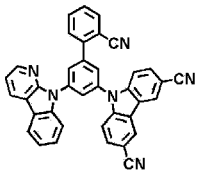

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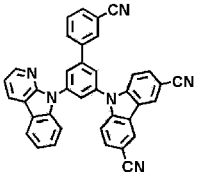

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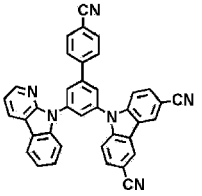

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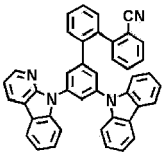

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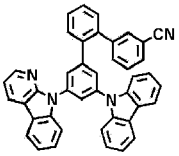

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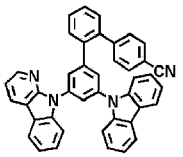

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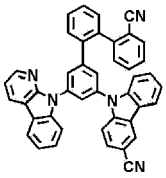

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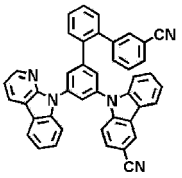

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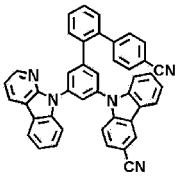

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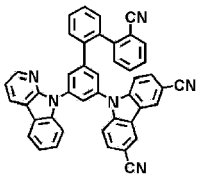

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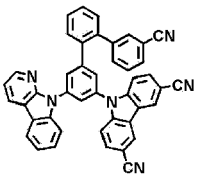

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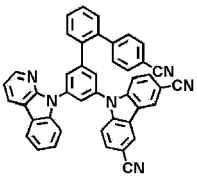

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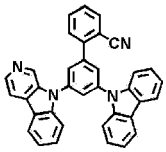

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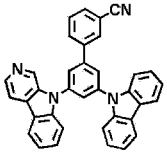

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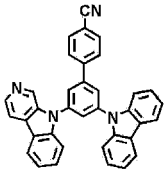

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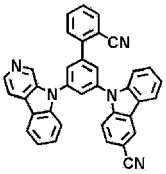

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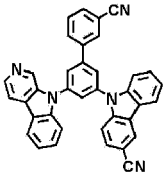

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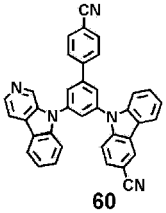

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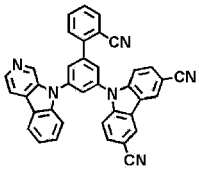

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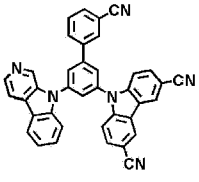

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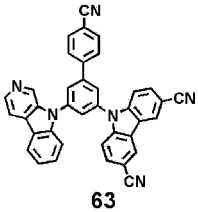

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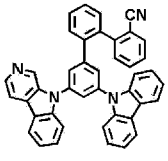

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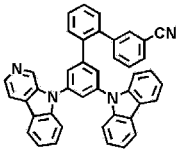

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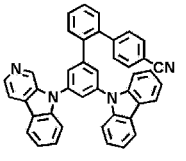

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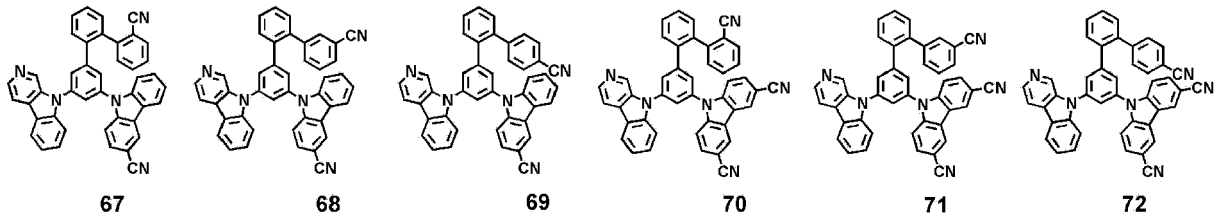

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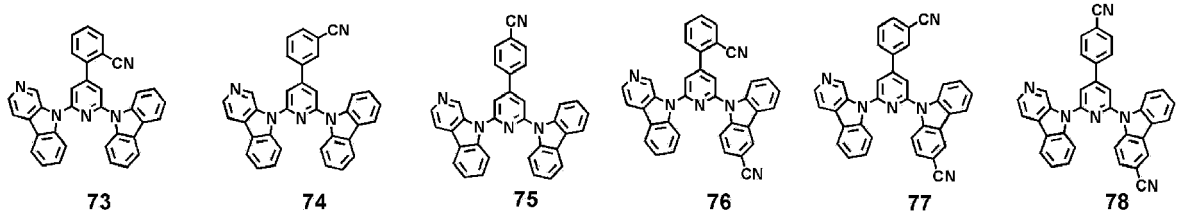

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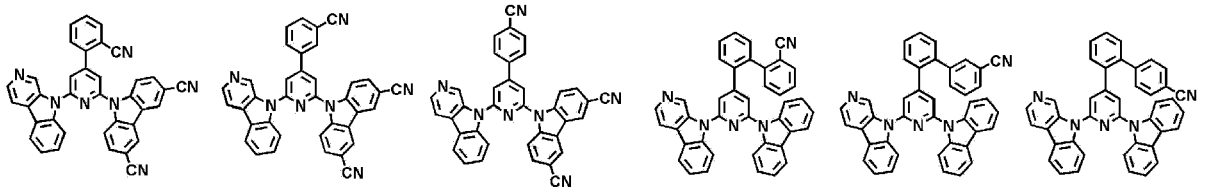

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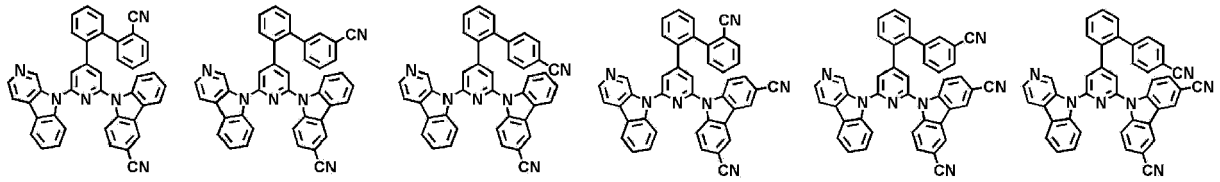
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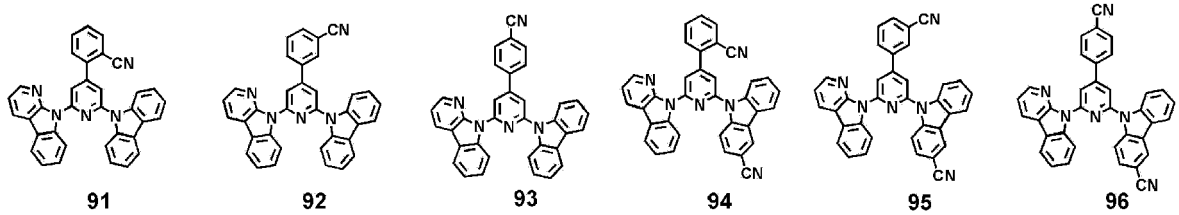
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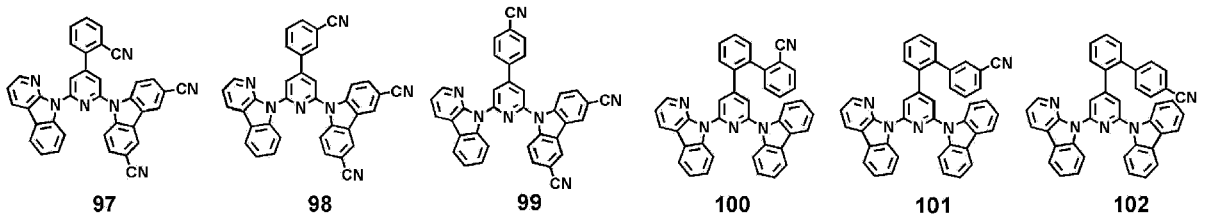
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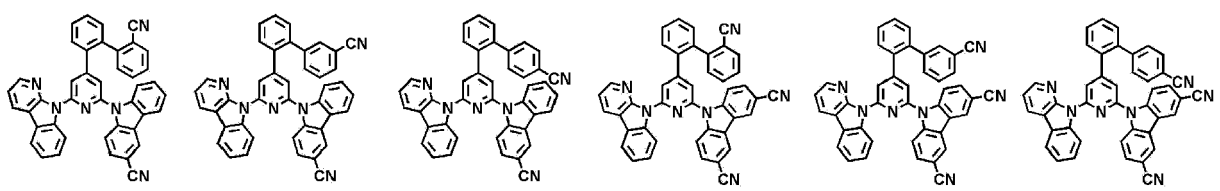
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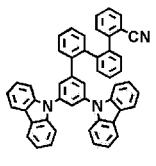
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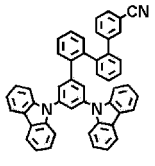
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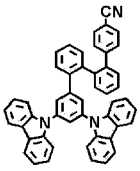
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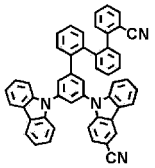
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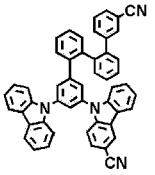
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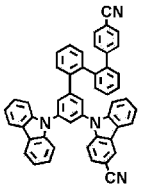
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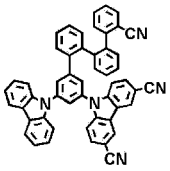
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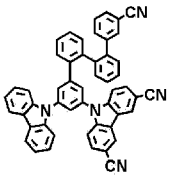
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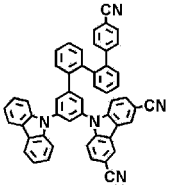
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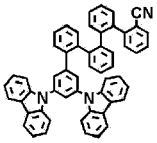
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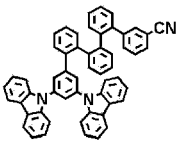
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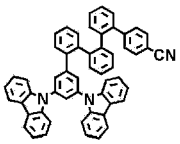
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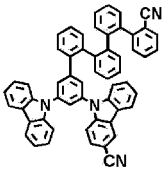
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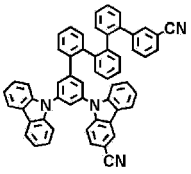
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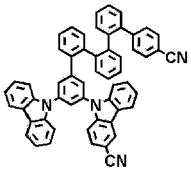
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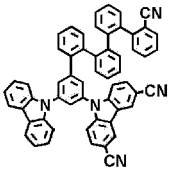
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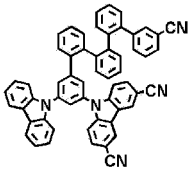
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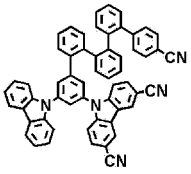
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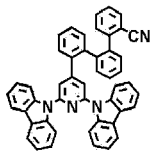
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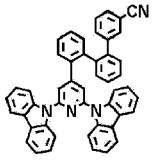
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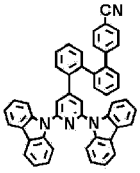
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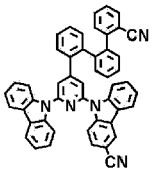
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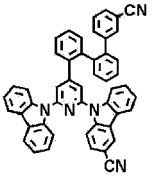
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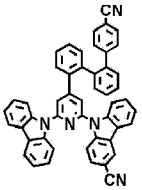
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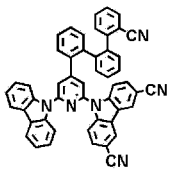
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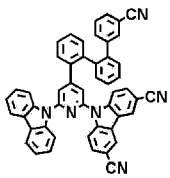
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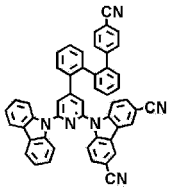
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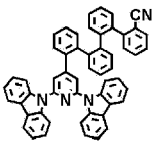
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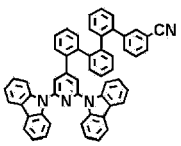
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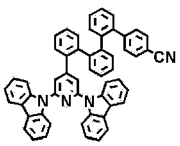
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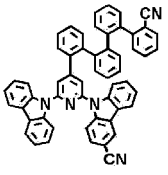
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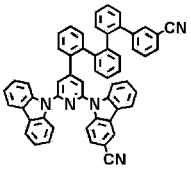
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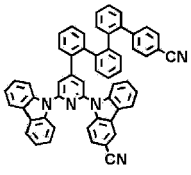
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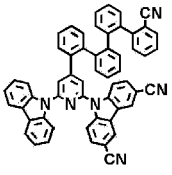
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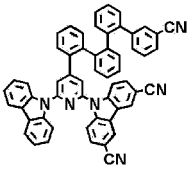
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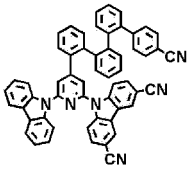
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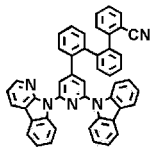
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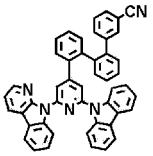


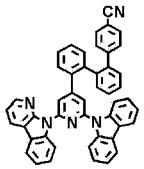
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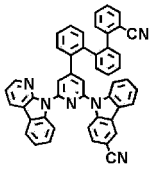


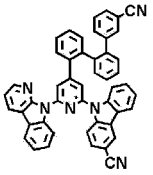
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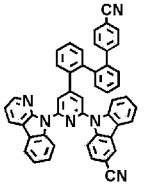

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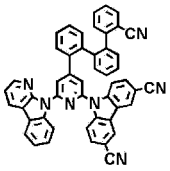

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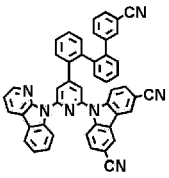

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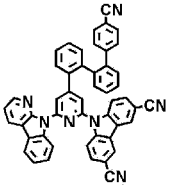

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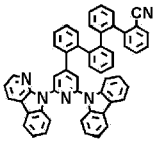

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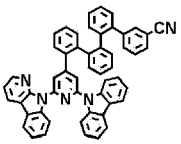

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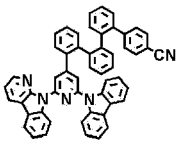

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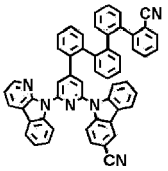

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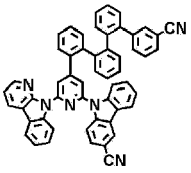

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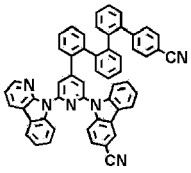

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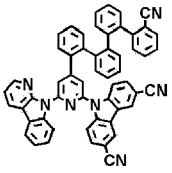

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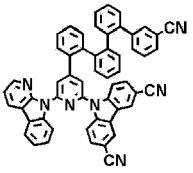

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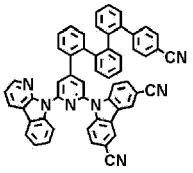

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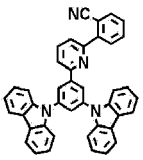

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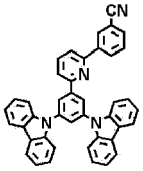

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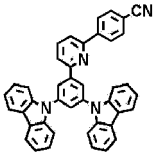

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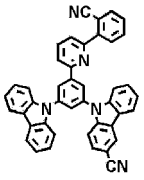

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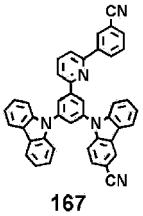

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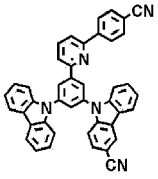

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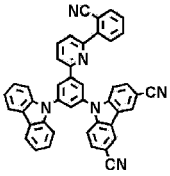

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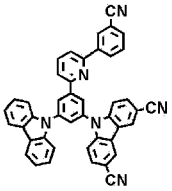

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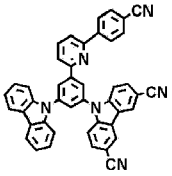

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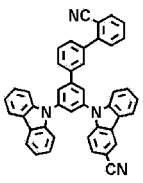

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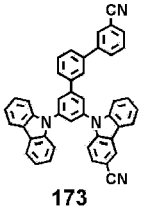

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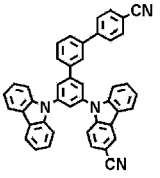

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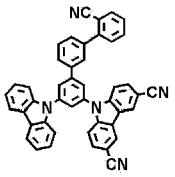

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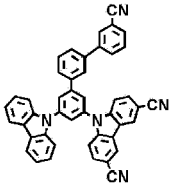

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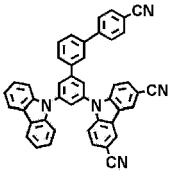

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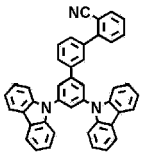

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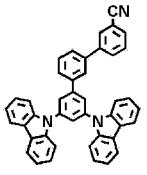

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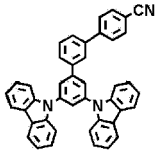

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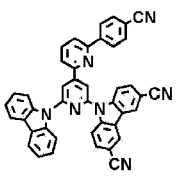

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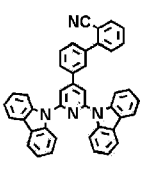

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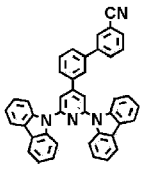

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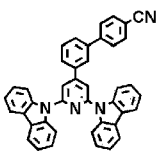

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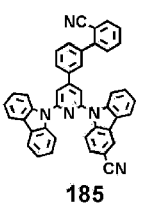

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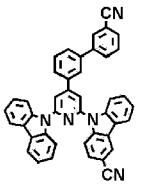

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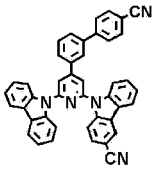

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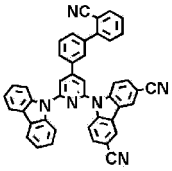

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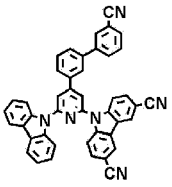

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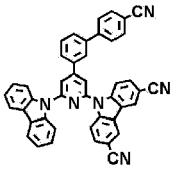

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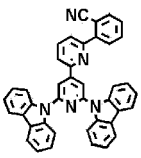

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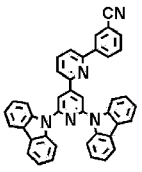

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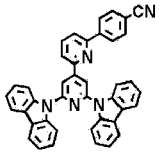

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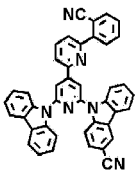

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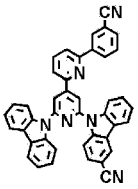

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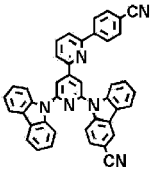

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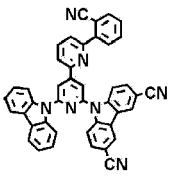

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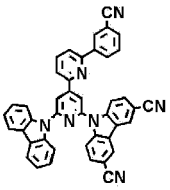

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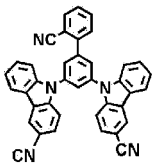

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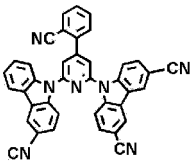

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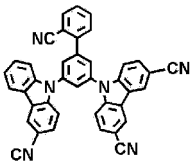

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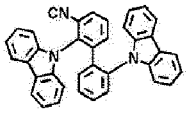

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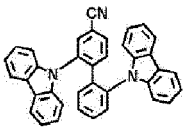

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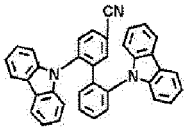

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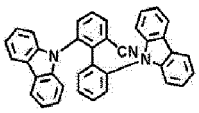

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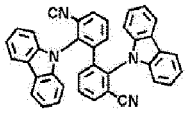
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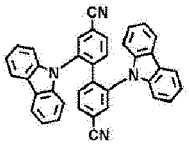

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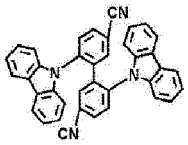

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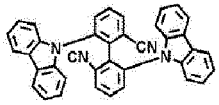

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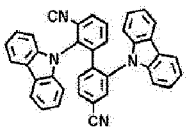

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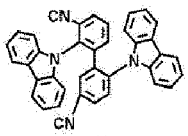

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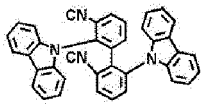

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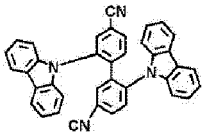

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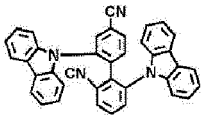

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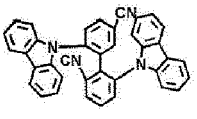

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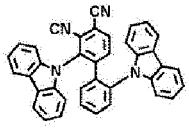

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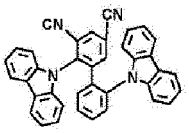

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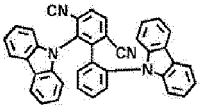

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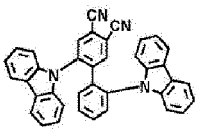

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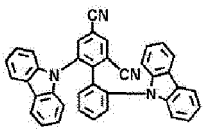

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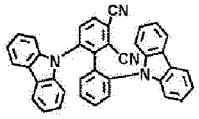

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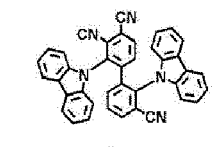

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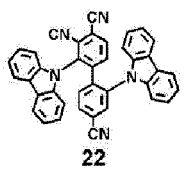

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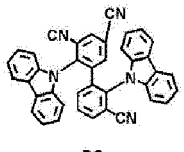

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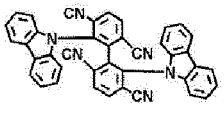

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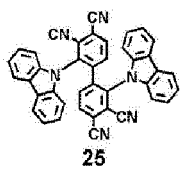

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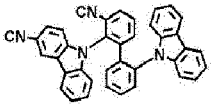

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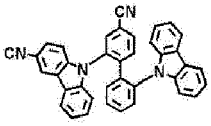

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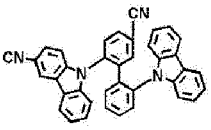

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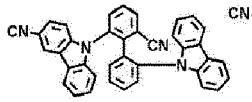

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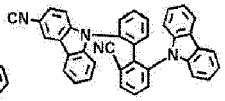

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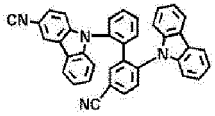

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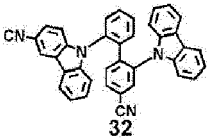

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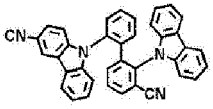

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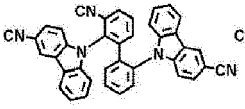

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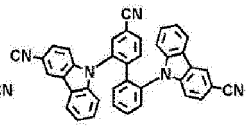

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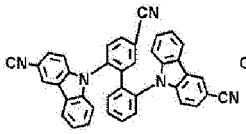

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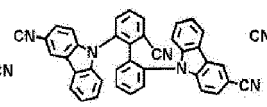

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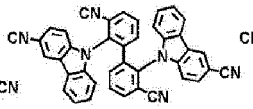

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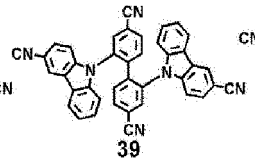

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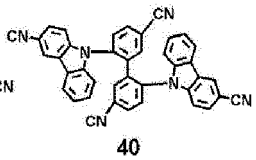

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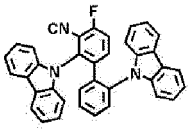

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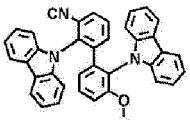

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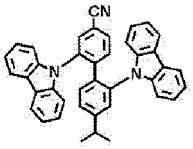

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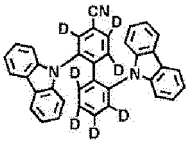

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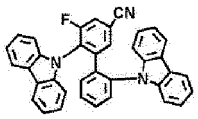

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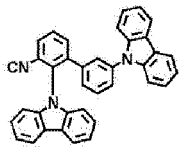

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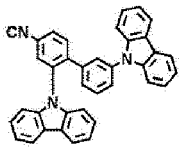

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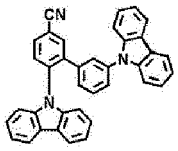

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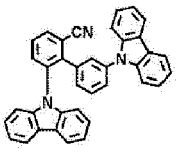

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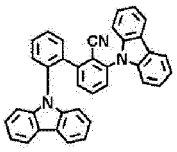

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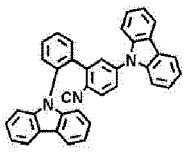

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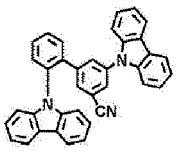

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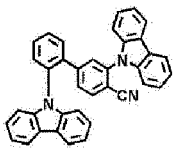

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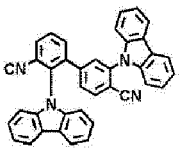

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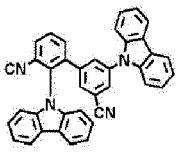

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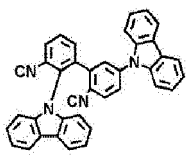

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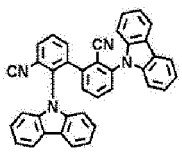

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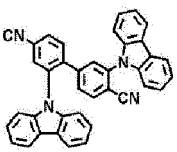

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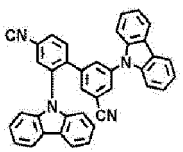

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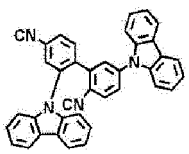

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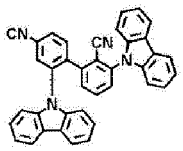

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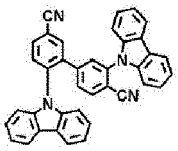

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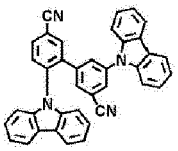

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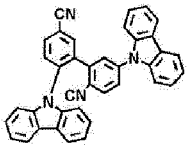

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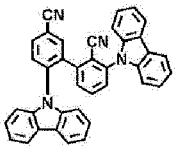

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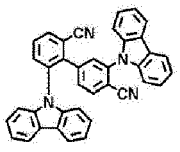

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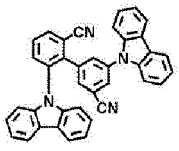

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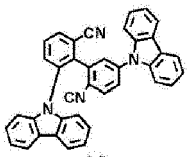

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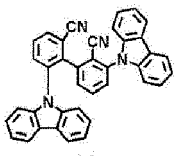

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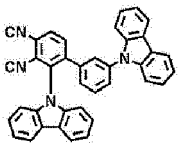

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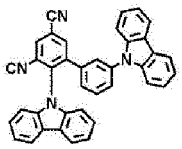

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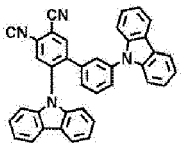

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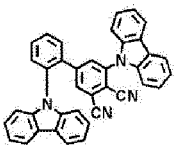

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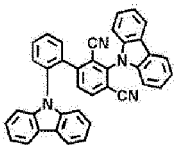

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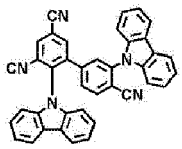

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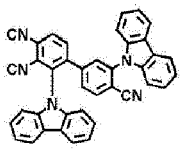

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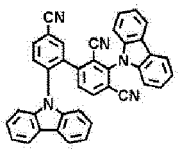

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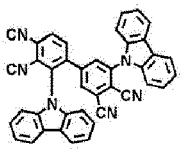

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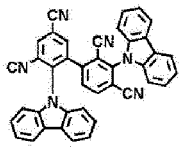

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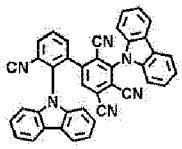

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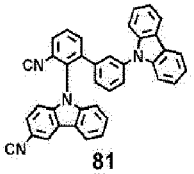

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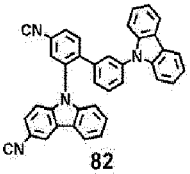

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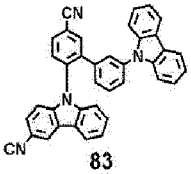

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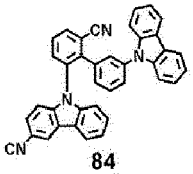

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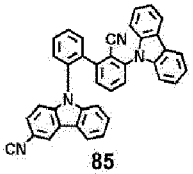

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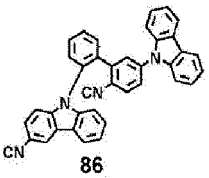

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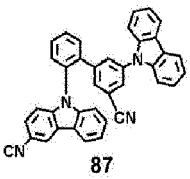

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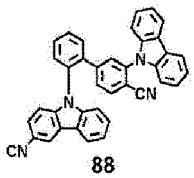

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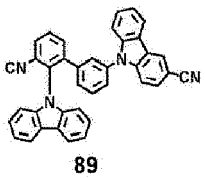

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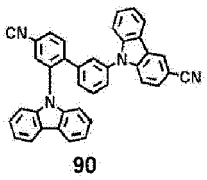

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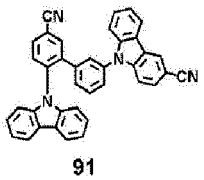

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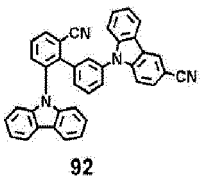

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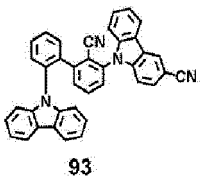

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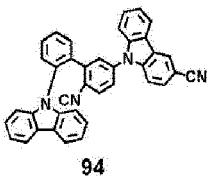

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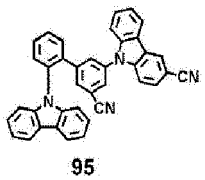

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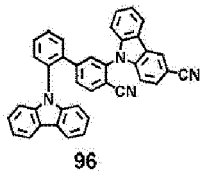

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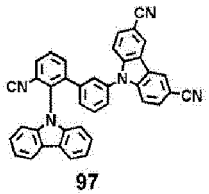

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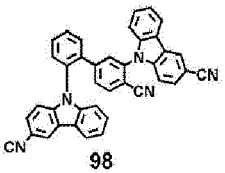

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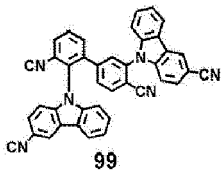

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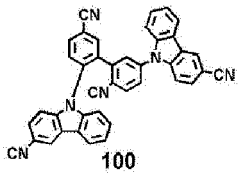

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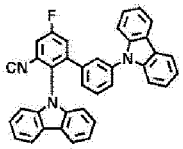

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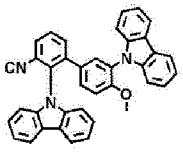

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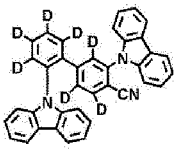

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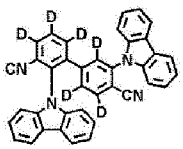

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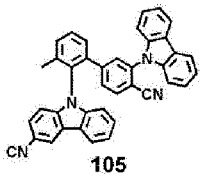

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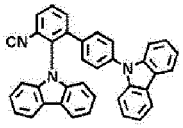

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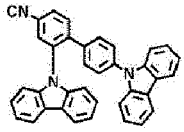

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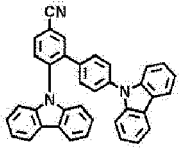

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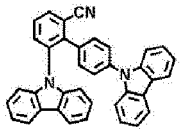

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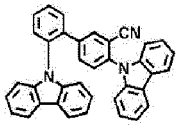

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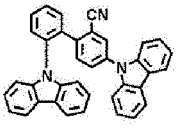

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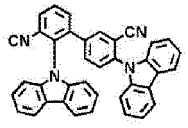

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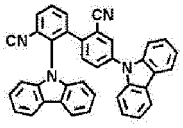

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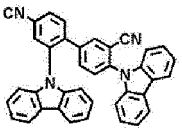

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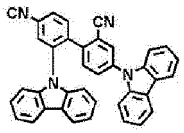

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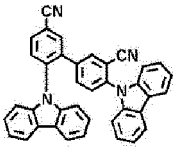

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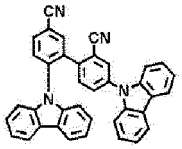

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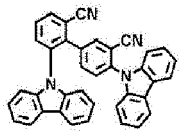

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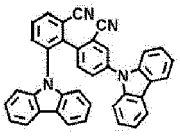

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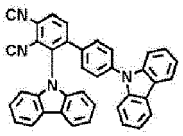

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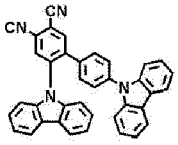

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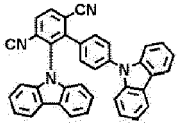

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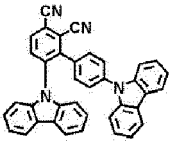

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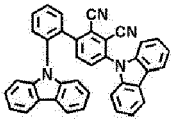

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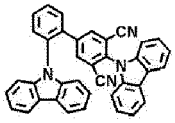

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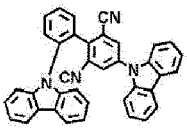

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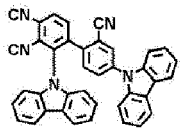

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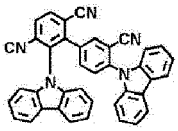

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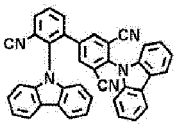

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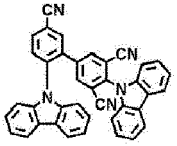

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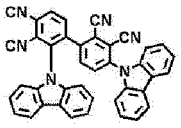

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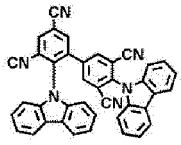

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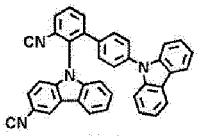

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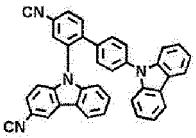

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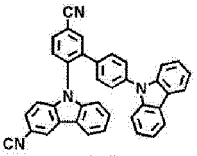

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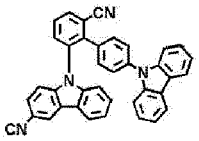

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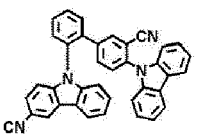

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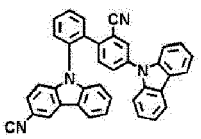

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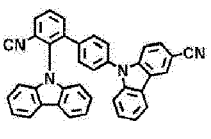

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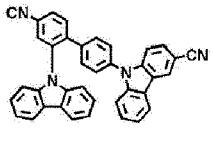

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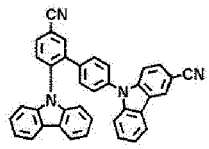

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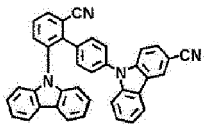

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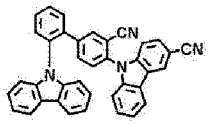

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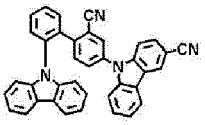

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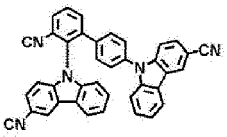

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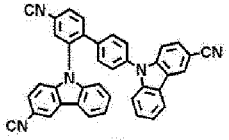

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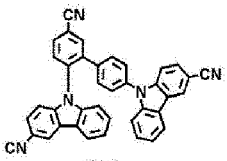

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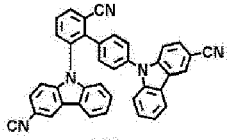

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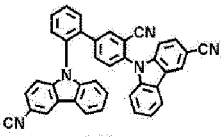

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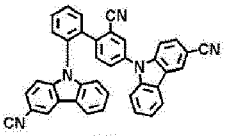

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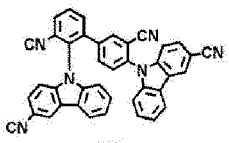

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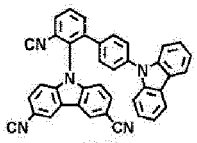

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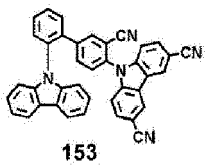

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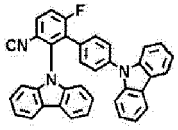

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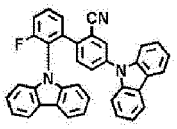

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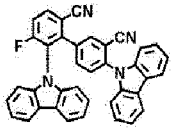

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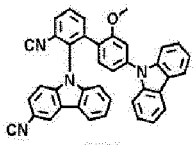

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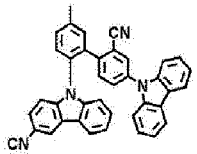

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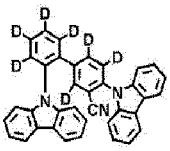

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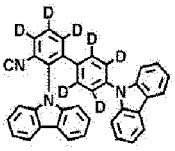

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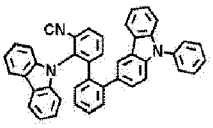

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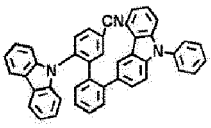

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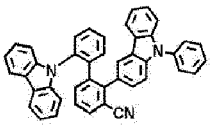

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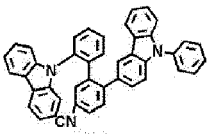

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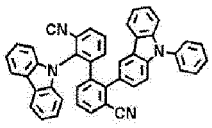

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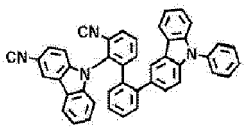

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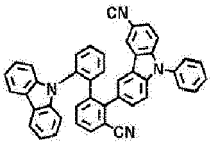

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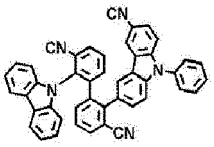

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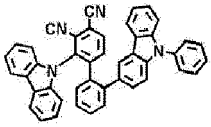

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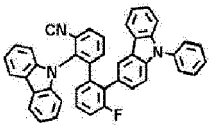

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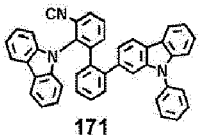

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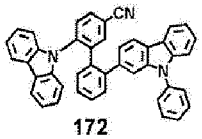

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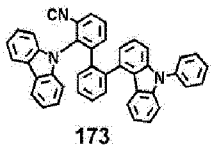

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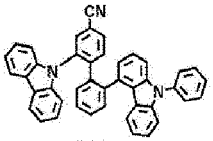

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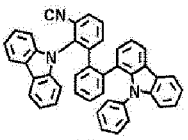

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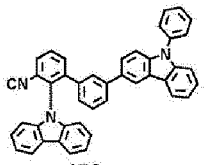

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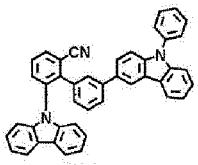

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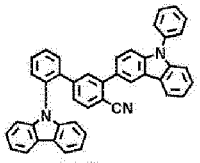

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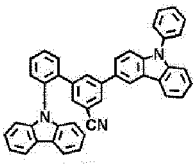

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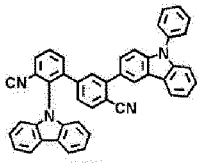

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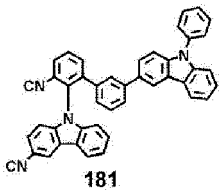

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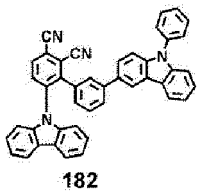

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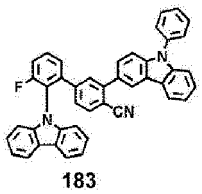

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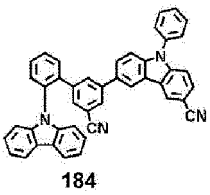

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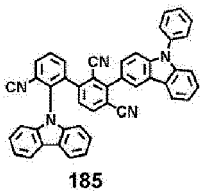

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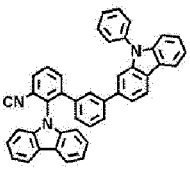

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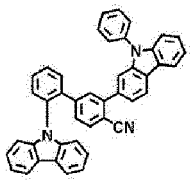

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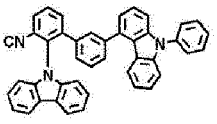

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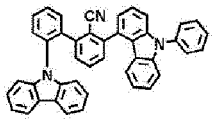

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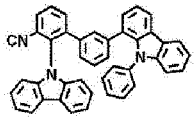

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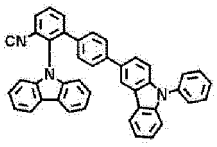

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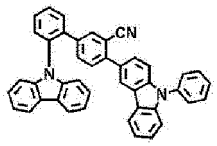

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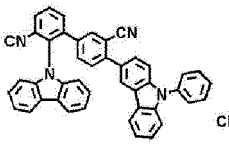

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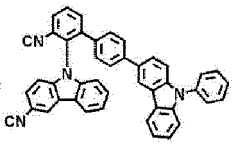

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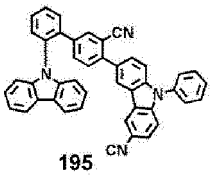

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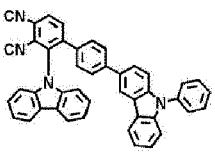

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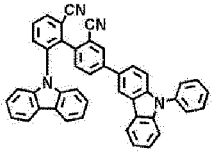

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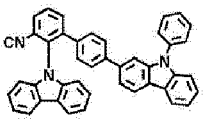

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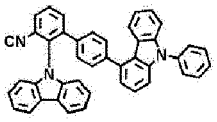

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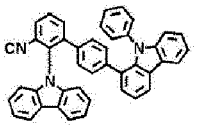

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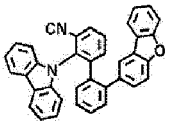

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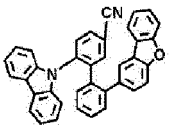

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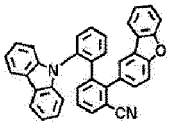

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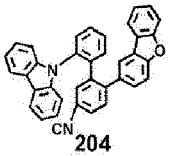

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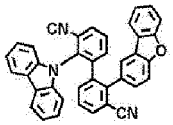

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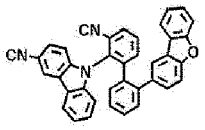

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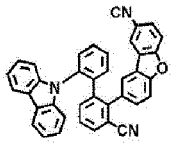

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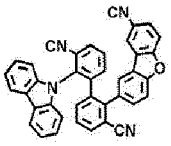

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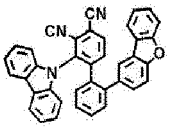

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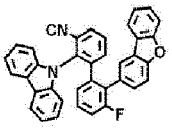

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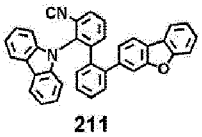

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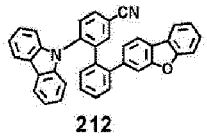

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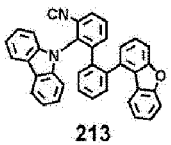

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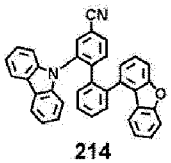

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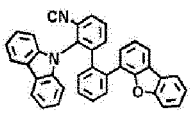

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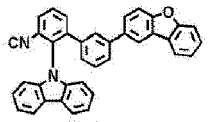

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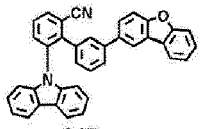

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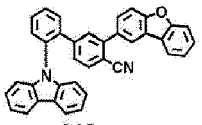

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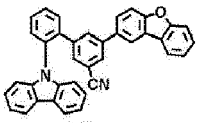

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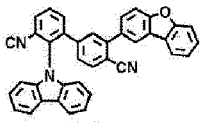

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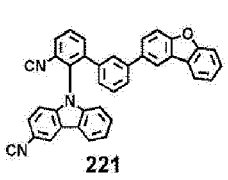

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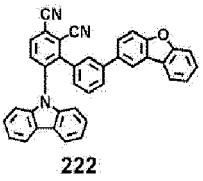

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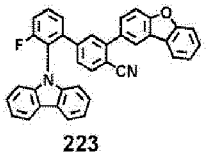

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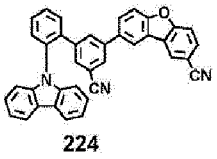

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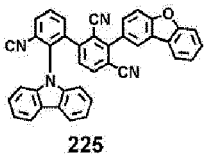

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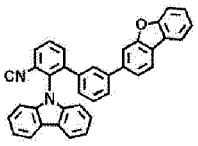

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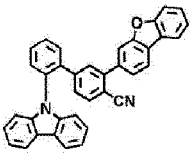

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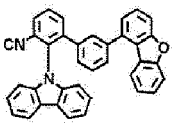

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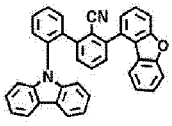

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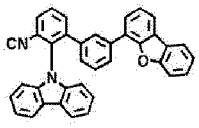

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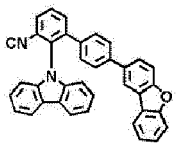

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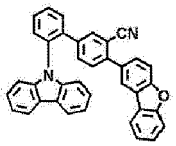

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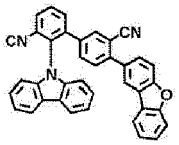

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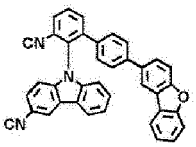

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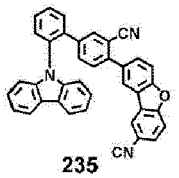

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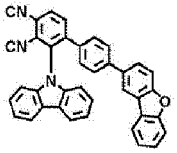

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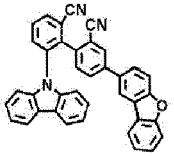

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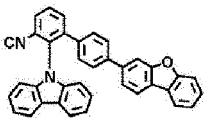

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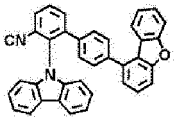

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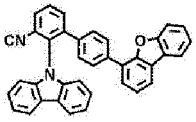

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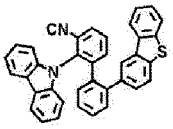

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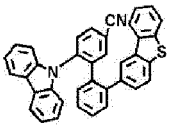

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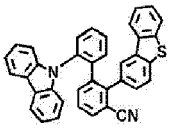

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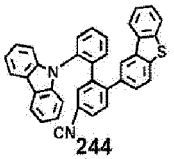

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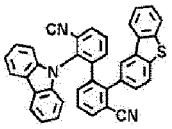

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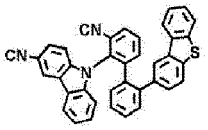

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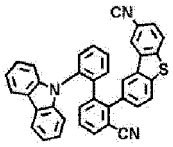

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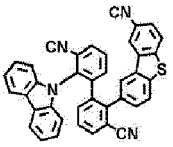

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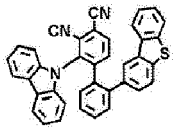

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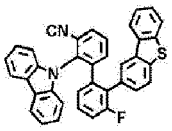

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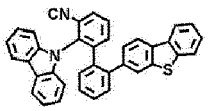

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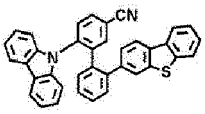

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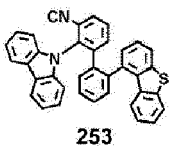

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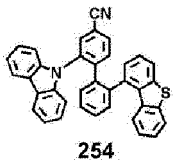

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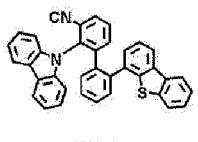

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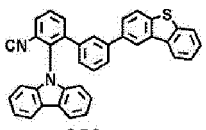

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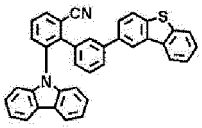

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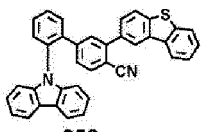

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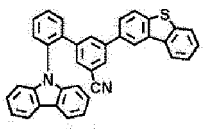

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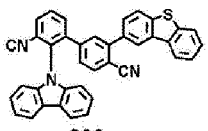

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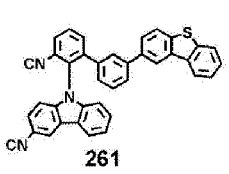

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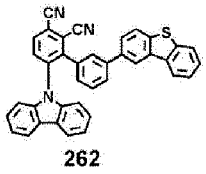

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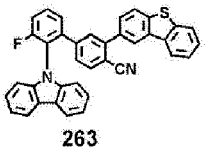

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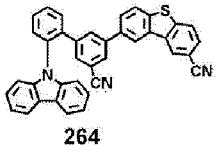

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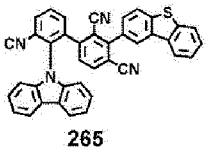

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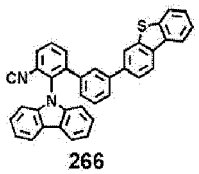

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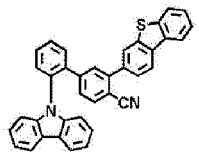

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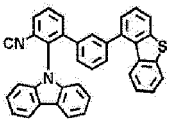

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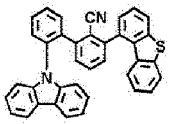

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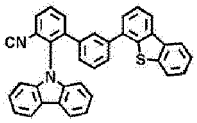

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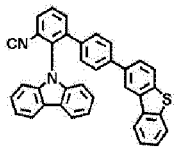

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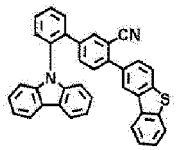

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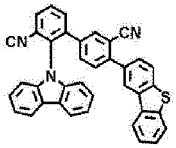

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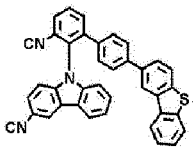

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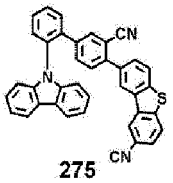

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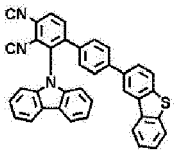

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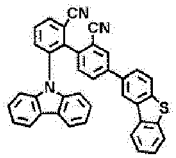

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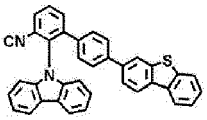

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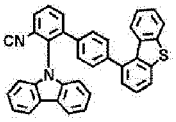

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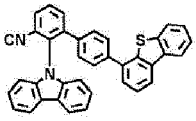

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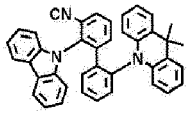

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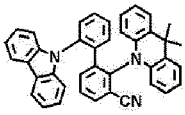

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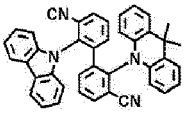

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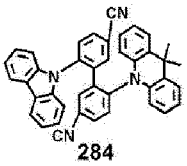

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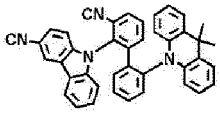

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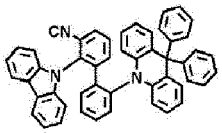

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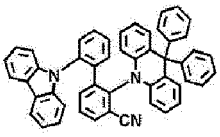

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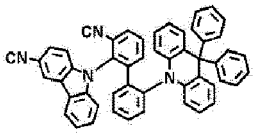

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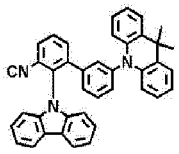

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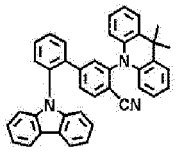

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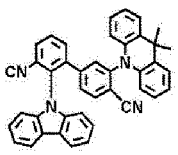

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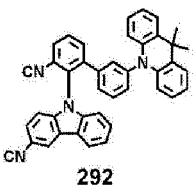

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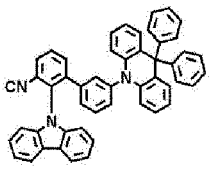

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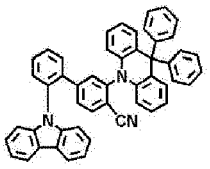

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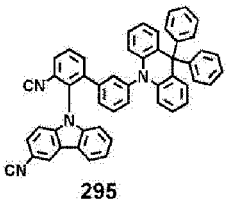

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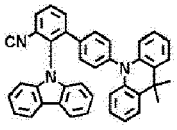

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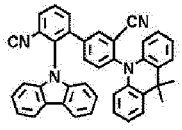

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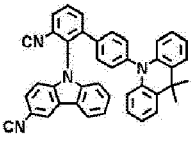

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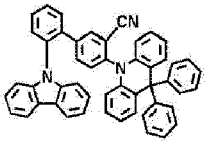

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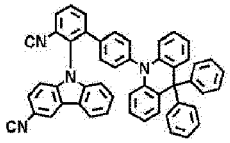

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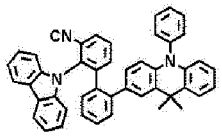

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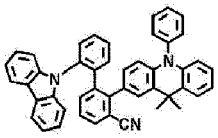

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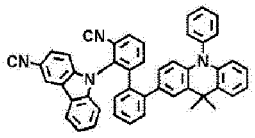

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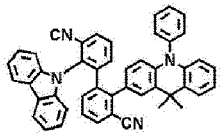

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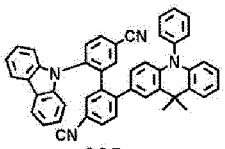

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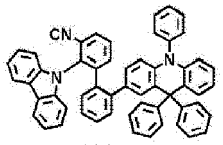

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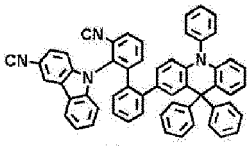

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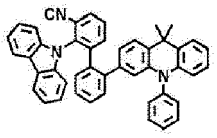

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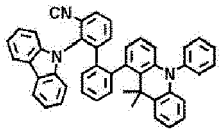

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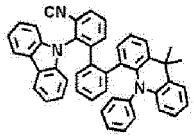

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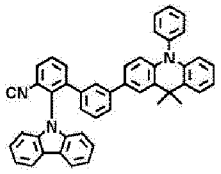

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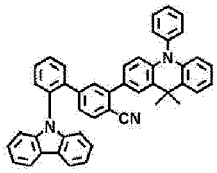

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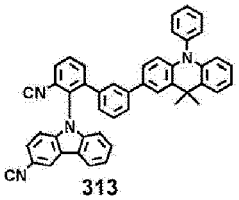

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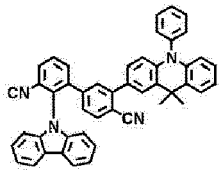

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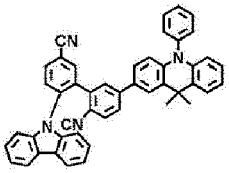

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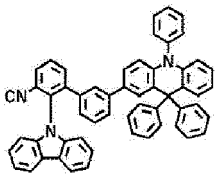

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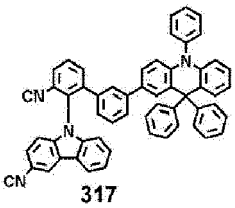

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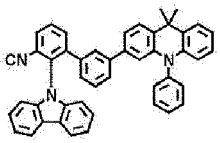

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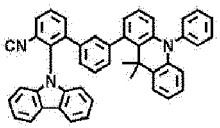

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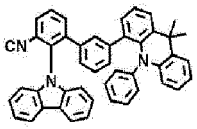

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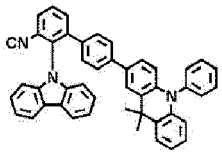

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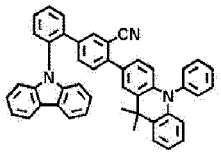

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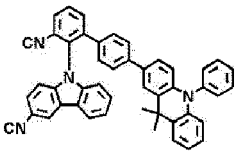

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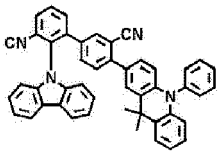

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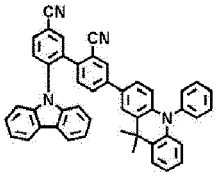

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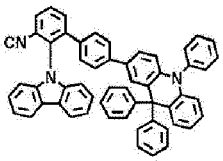

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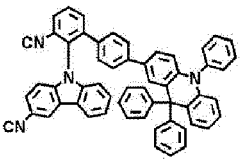

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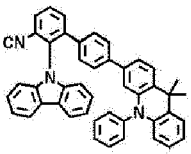

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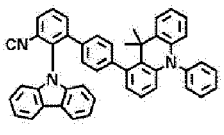

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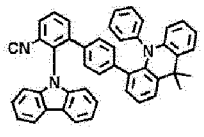

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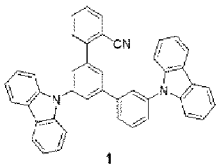

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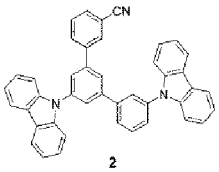

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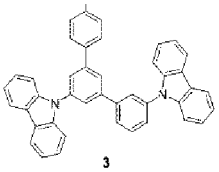

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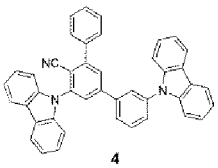

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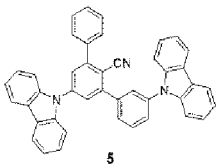
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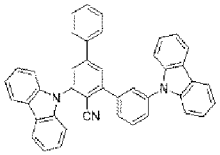

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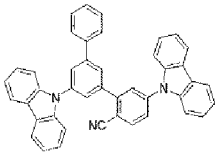

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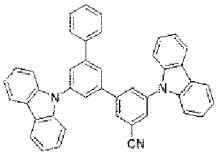

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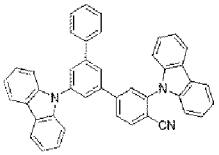

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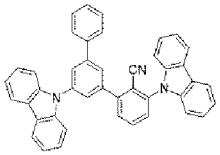

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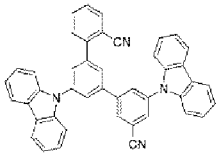

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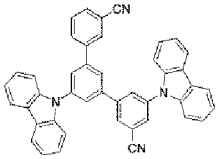

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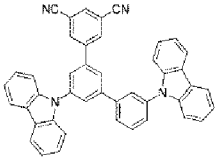

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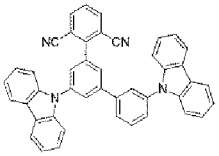

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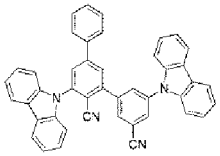

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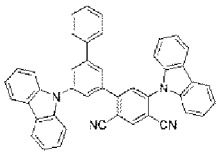

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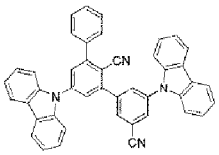

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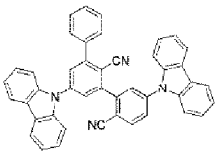

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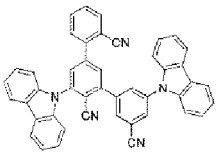

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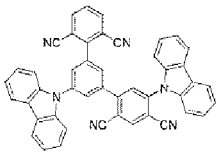

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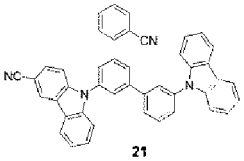

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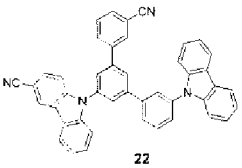

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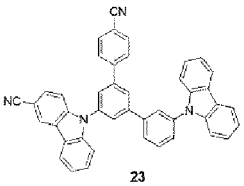

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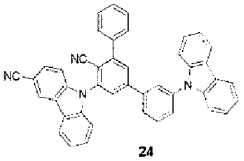

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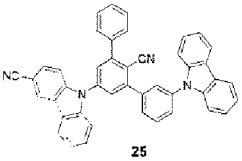

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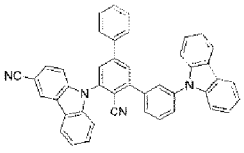

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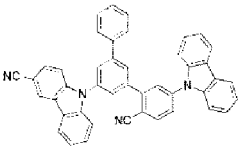

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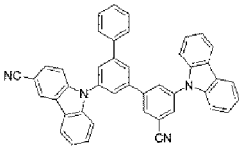

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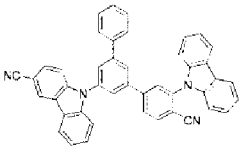

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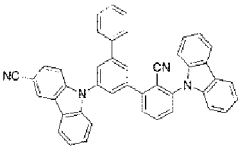

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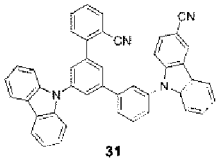

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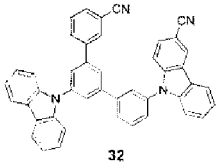

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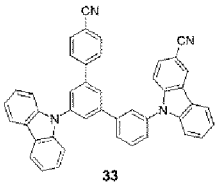

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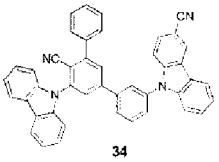

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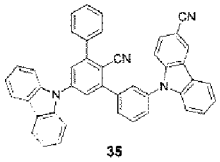

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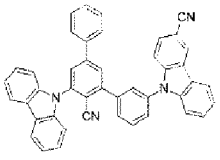

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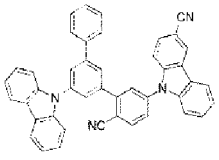

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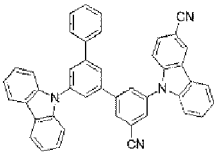

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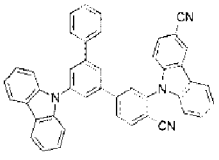

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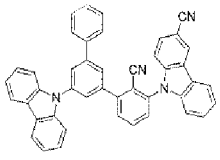

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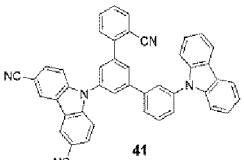

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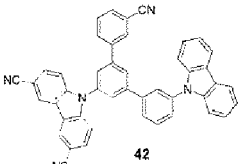

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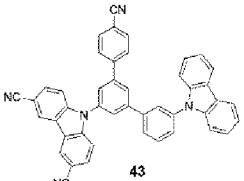

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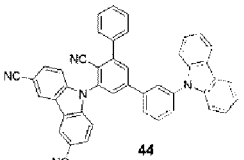

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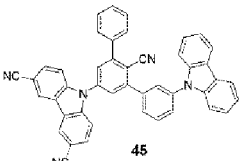

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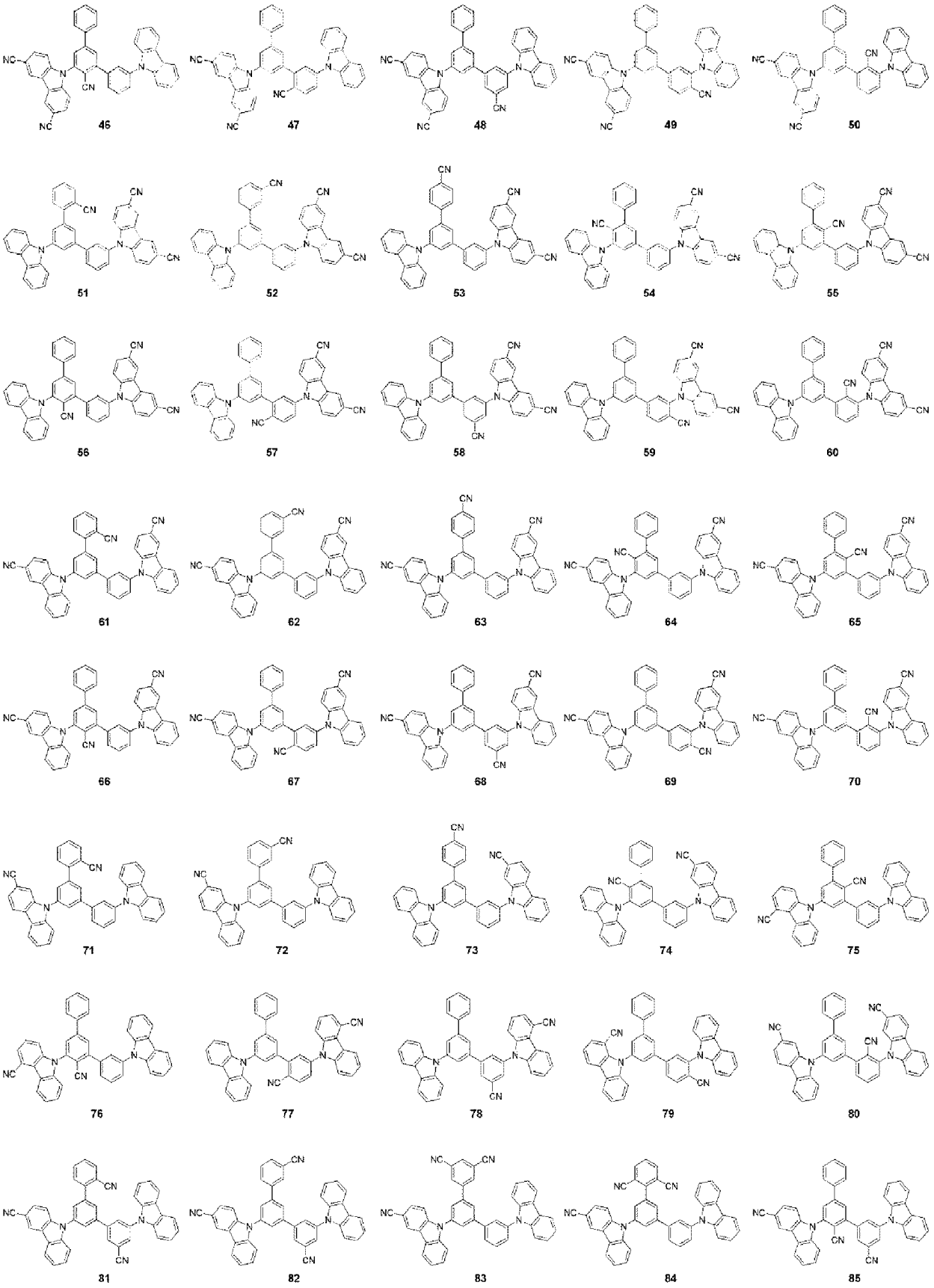

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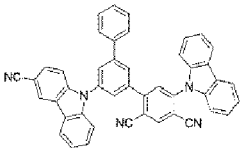

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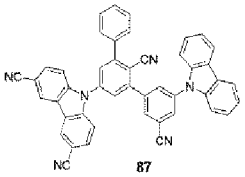

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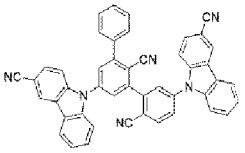

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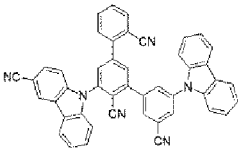

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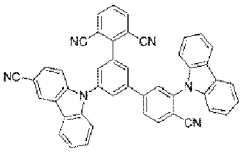

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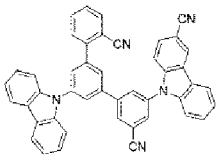

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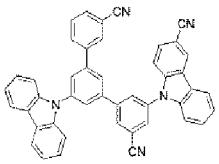

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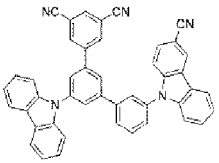

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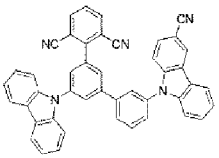

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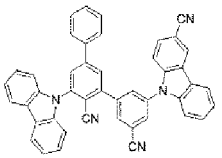

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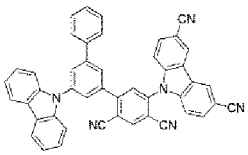

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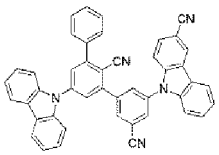

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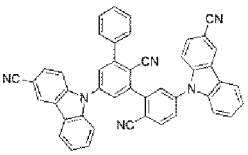

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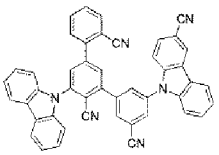

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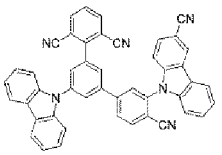

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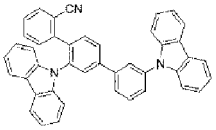

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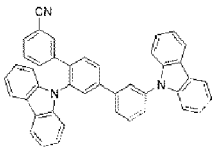

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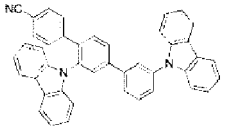

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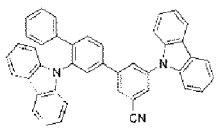

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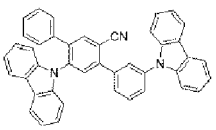

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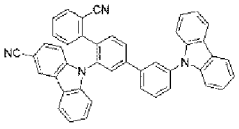

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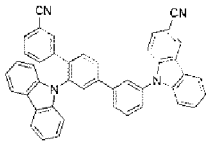

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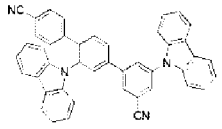

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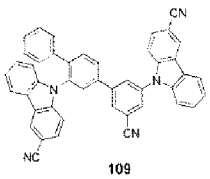

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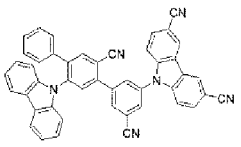

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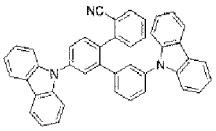

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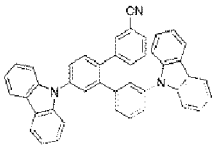

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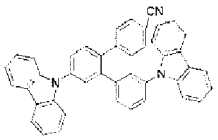

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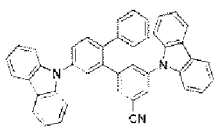

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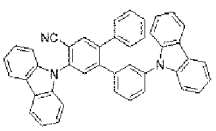

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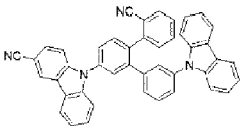

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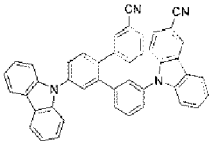

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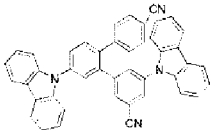

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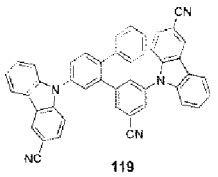

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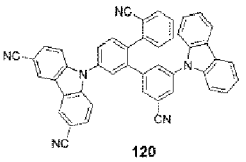

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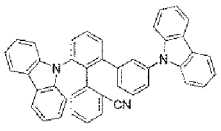

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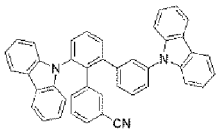

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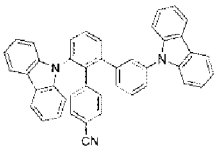

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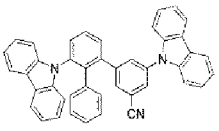

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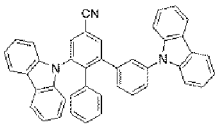

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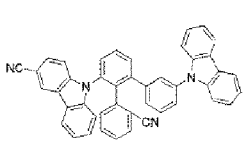

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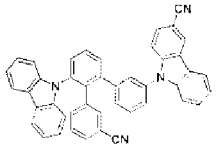

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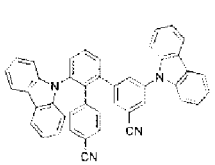

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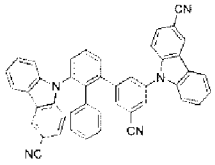
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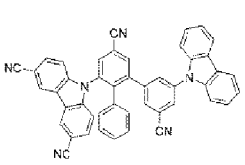
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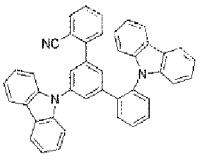
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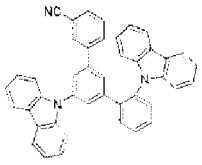
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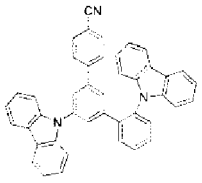
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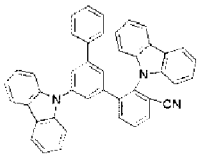
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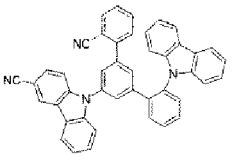
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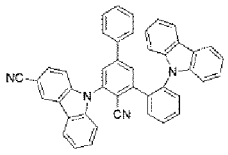
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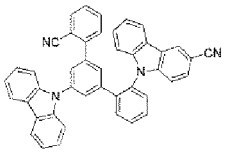
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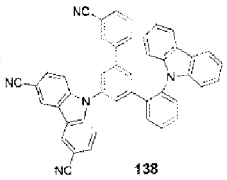
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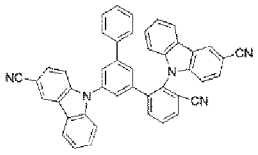
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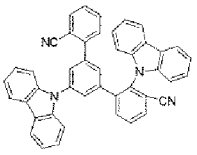
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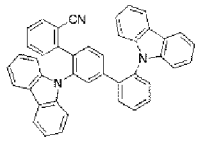
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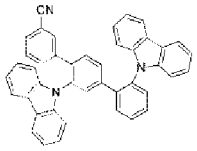
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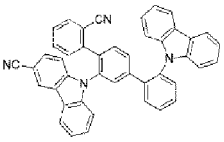
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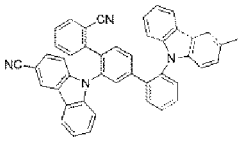
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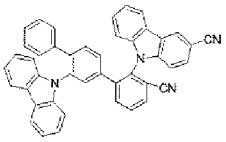
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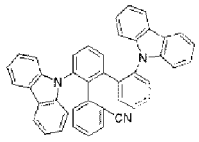
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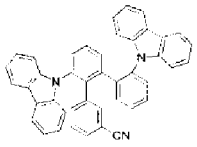
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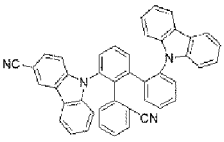
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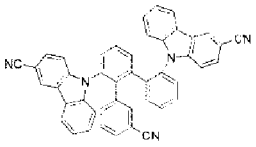
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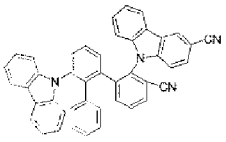
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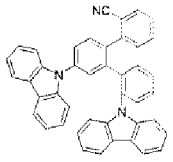
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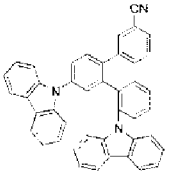
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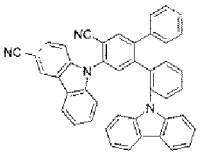
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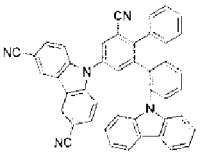
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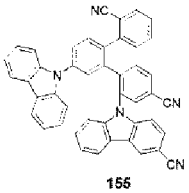
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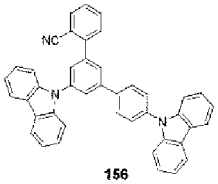
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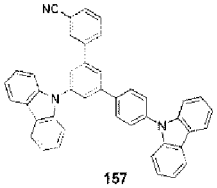
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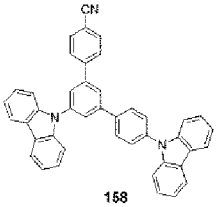
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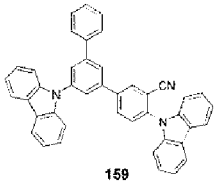
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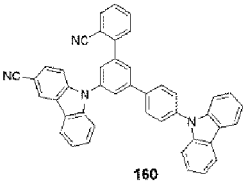
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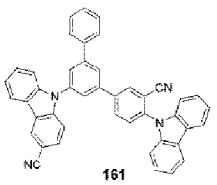
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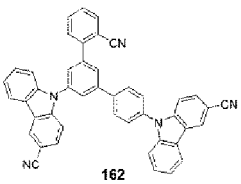


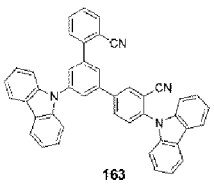
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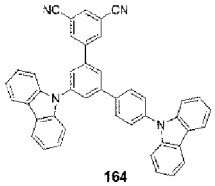


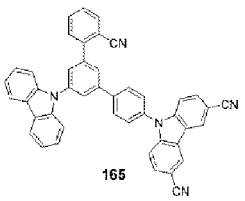
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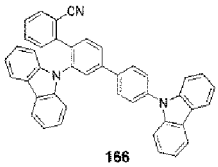

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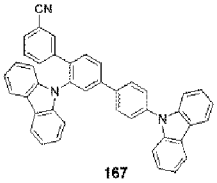

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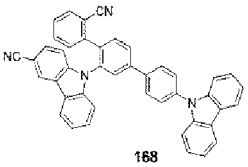

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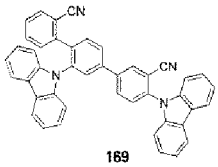

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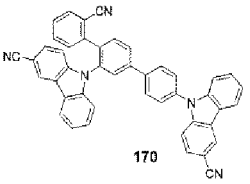

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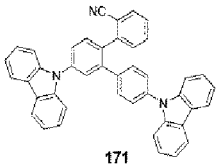

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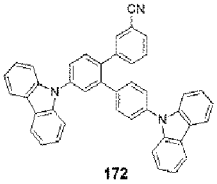

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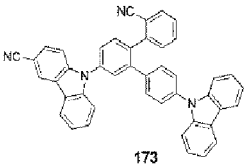

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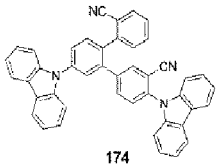

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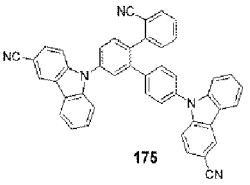

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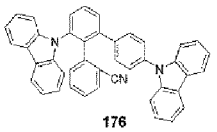

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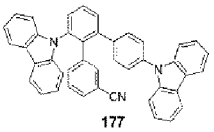

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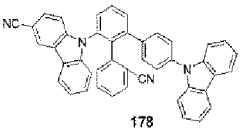

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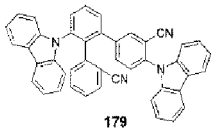

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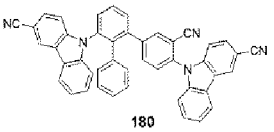

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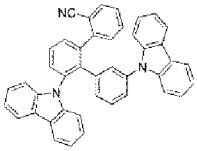

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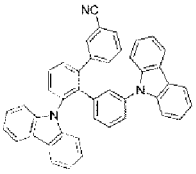

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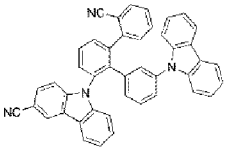

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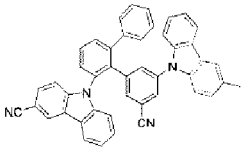

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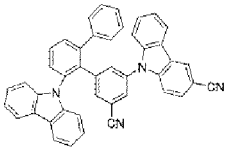

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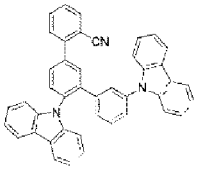

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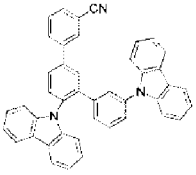

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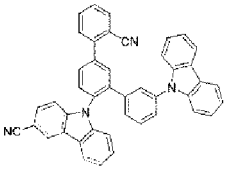

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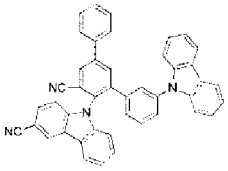

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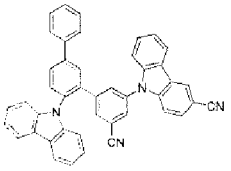

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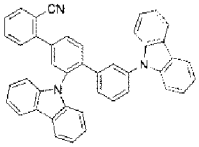

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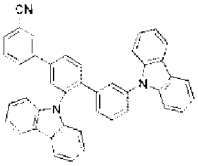

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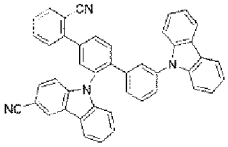

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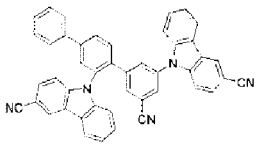

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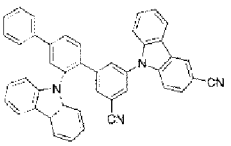

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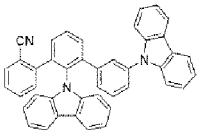

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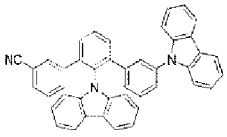

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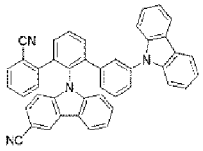

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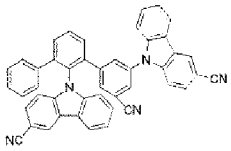
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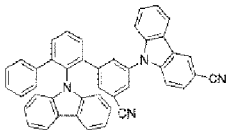
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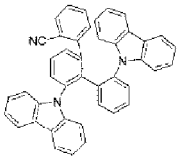
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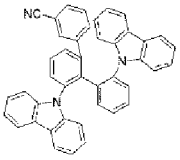
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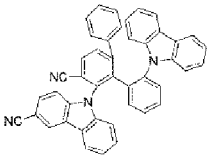
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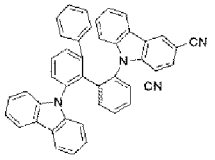
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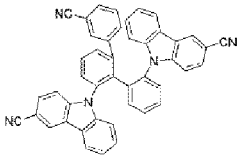
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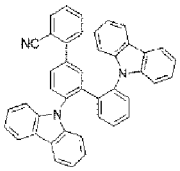
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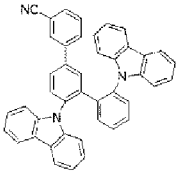
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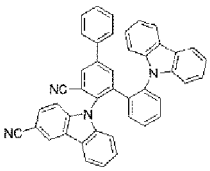
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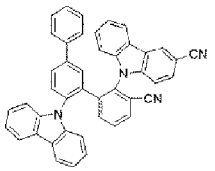
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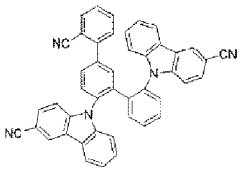
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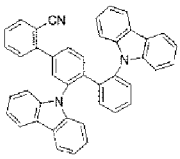
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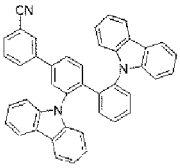
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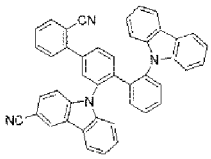
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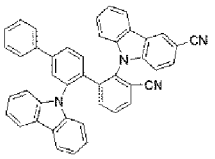
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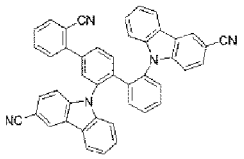
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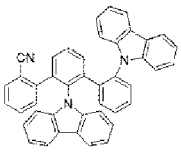
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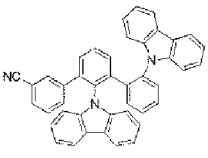
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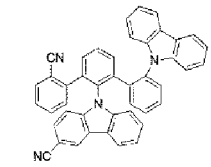
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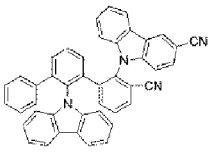
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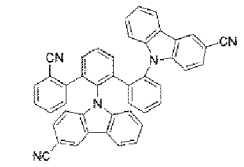
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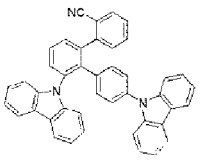
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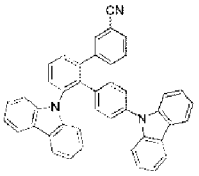
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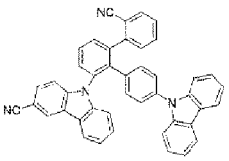
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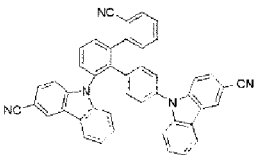
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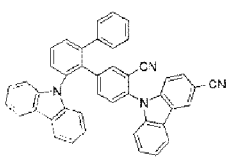
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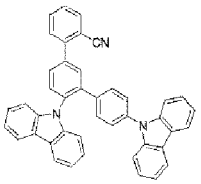
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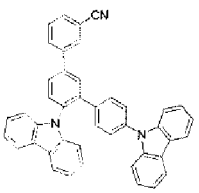
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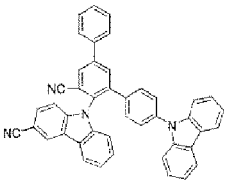
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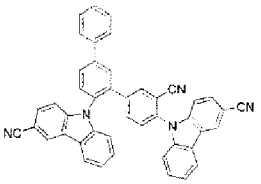
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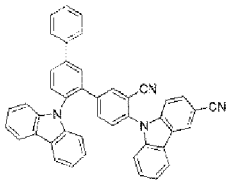
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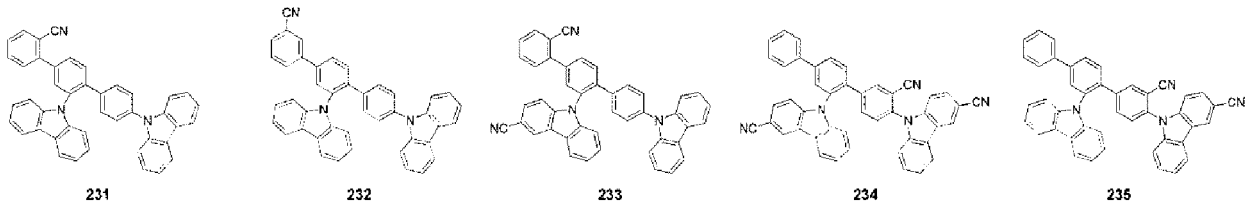
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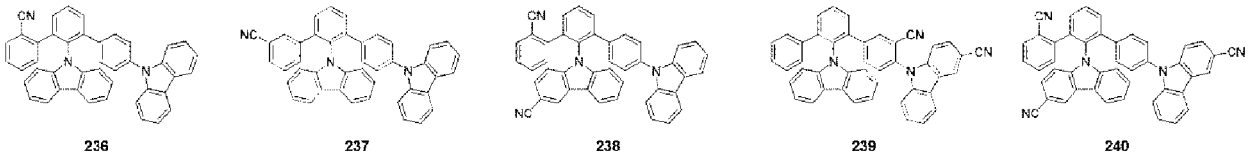
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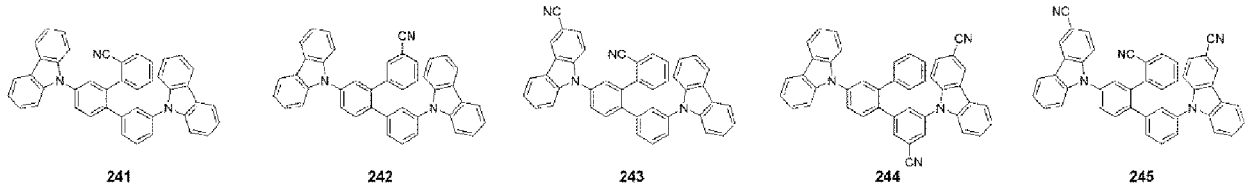
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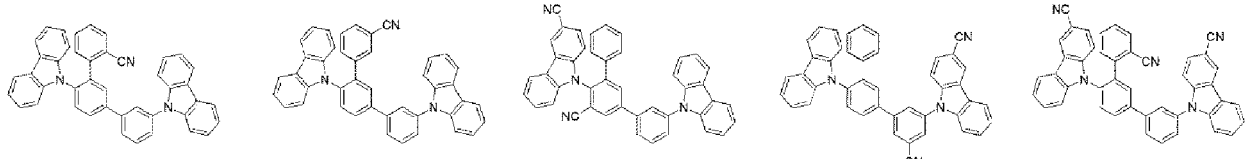
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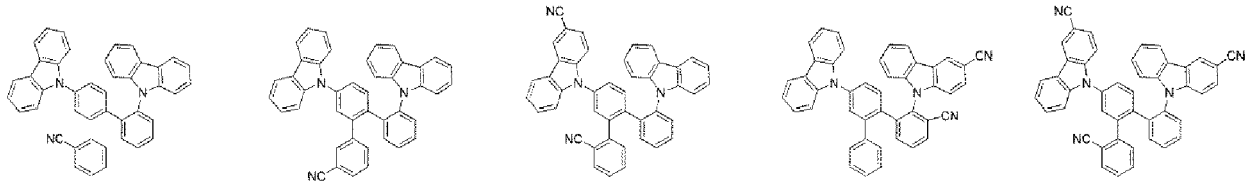
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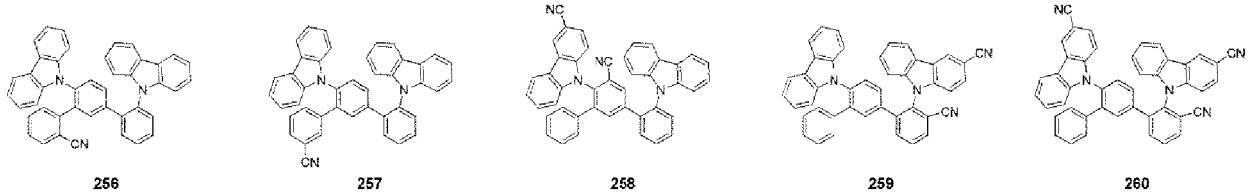
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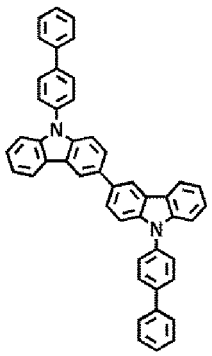


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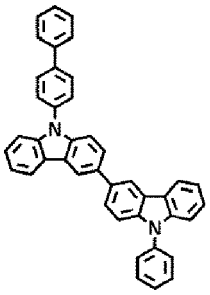


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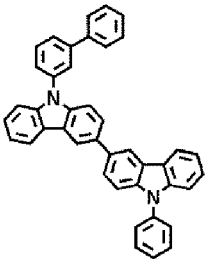
[0071] In one embodiment, the hole transport host may be selected from Compounds H-H1 to H-H103, but embodiments of the present disclosure are not limited thereto:



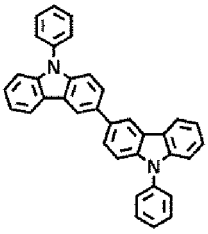
H-H1



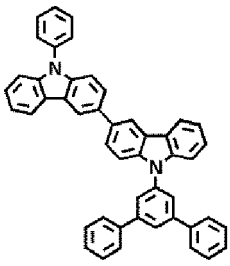
H-H2



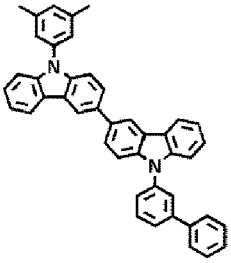
H-H3



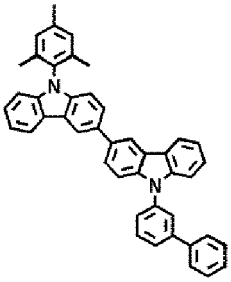
H-H4



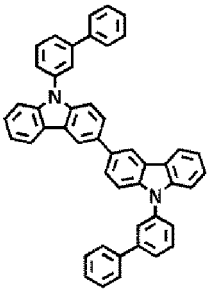
H-H5



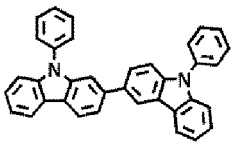
H-H6



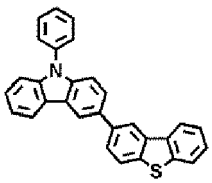
H-H7



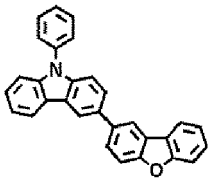
H-H8



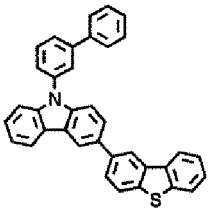
H-H9



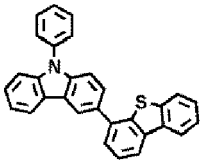
H-H10



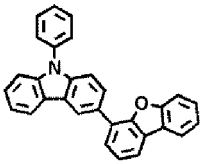
H-H11



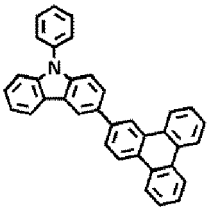
H-H12



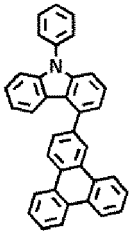
H-H13



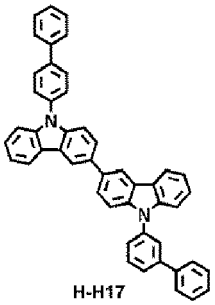
H-H14



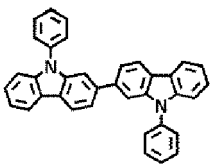
H-H15



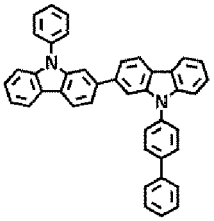
H-H16



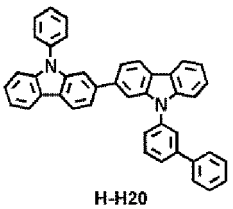
H-H17



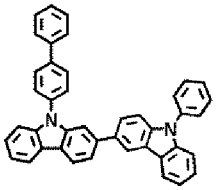
H-H18



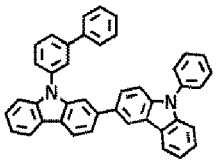
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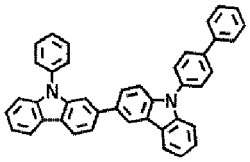
H-H20



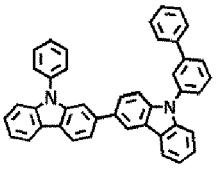
H-H21



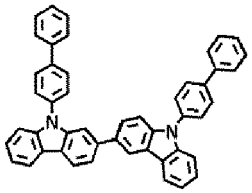
H-H22



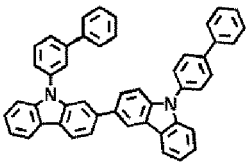
H-H23



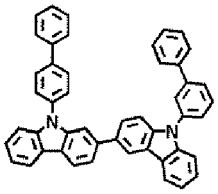
H-H24



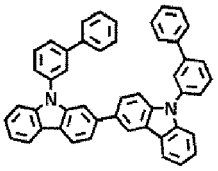
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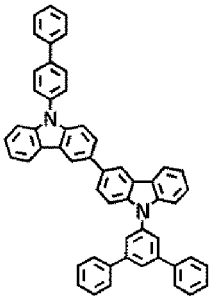
H-H26



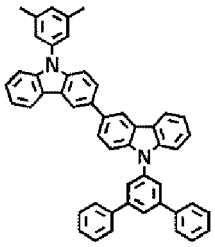
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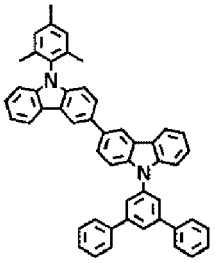
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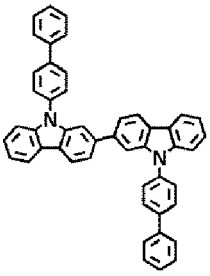
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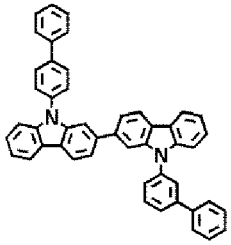
H-H30



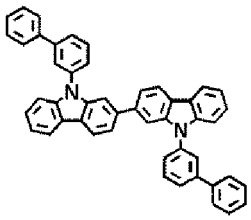
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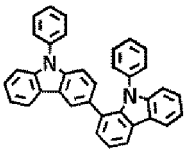
H-H32



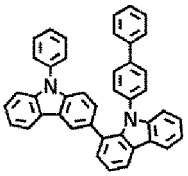
H-H33



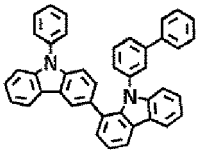
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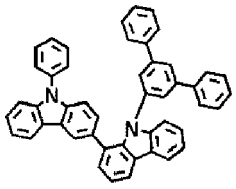
H-H35



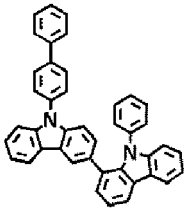
H-H36



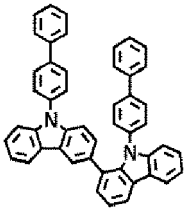
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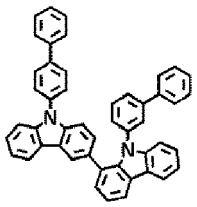
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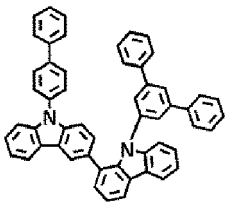
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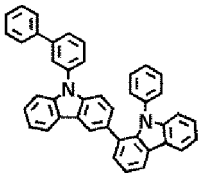
H-H40



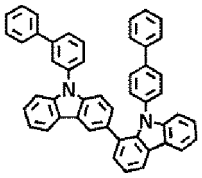
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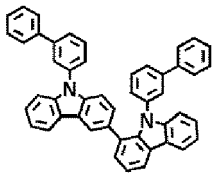
H-H42



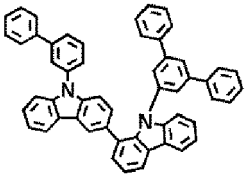
H-H43



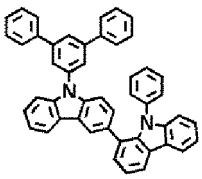
H-H44



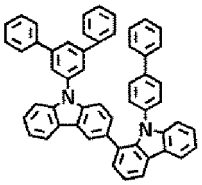
H-H45



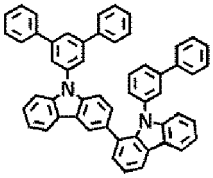
H-H46



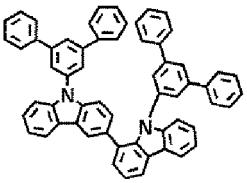
H-H47



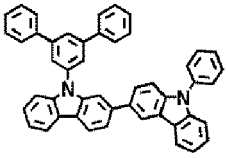
H-H48



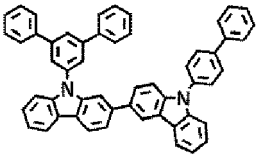
H-H49



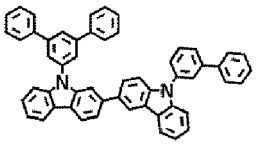
H-H50



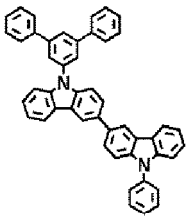
H-H51



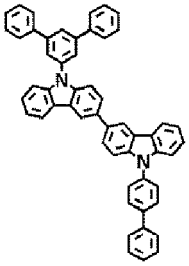
H-H52



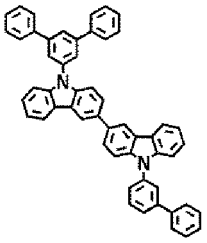
H-H53



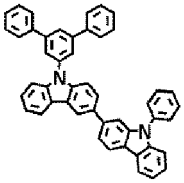
H-H54



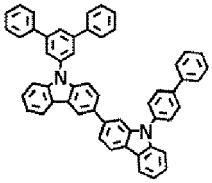
H-H55



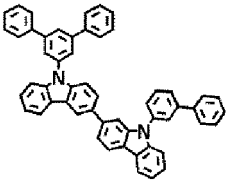
H-H56



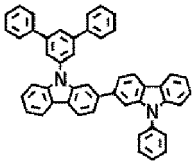
H-H57



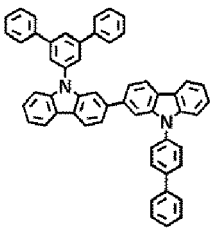
H-H58



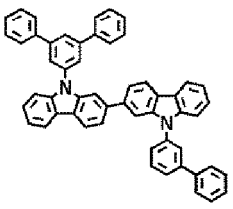
H-H59



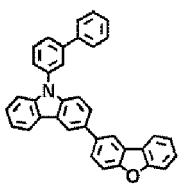
H-H60



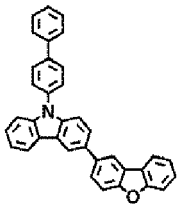
H-H61



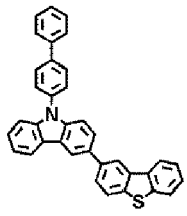
H-H62



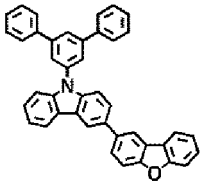
H-H63



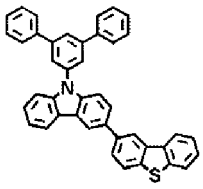
H-H64



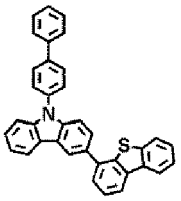
H-H65



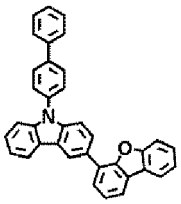
H-H66



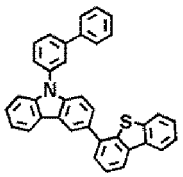
H-H67



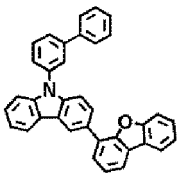
H-H68



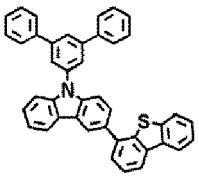
H-H69



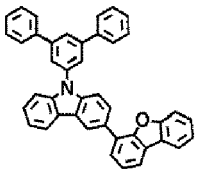
H-H70



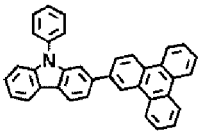
H-H71



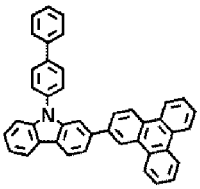
H-H72



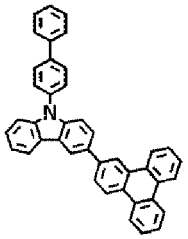
H-H73



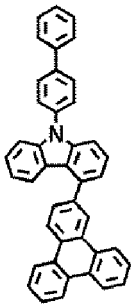
H-H74



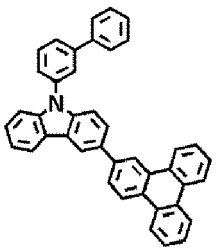
H-H75



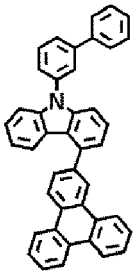
H-H76



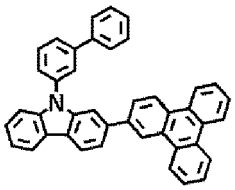
H-H77



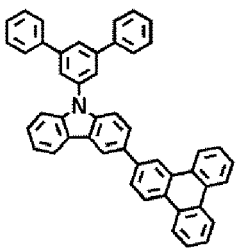
H-H78



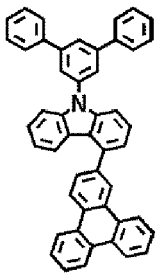
H-H79



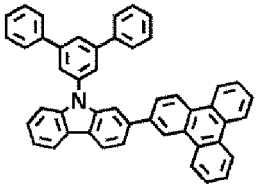
H-H80



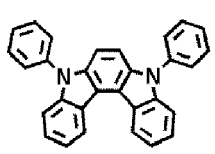
H-H81



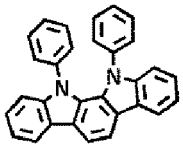
H-H82



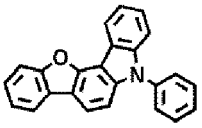
H-H83



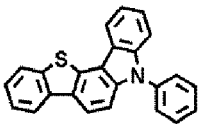
H-H84



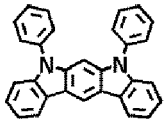
H-H85



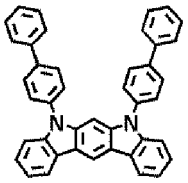
H-H86



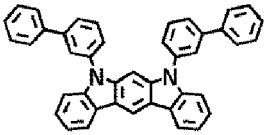
H-H87



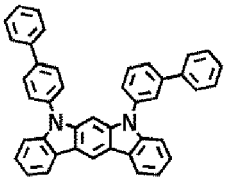
H-H88



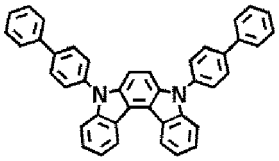
H-H89



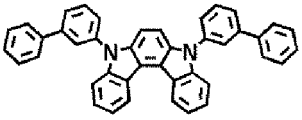
H-H90



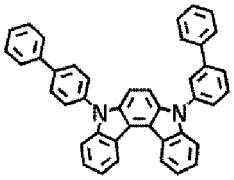
H-H91



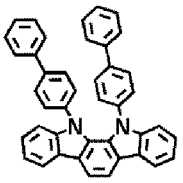
H-H92



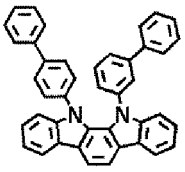
H-H93



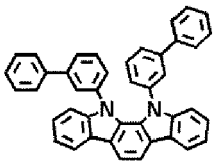
H-H94



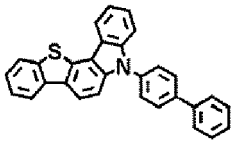
H-H95



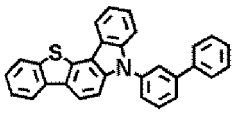
H-H96



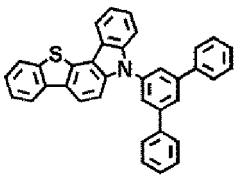
H-H97



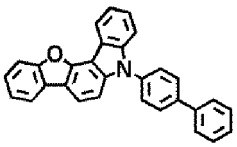
H-H98



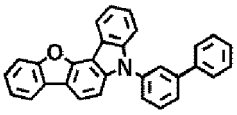
H-H99



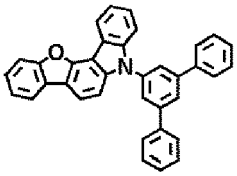
H-H100



H-H101



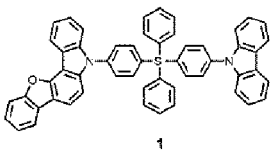
H-H102



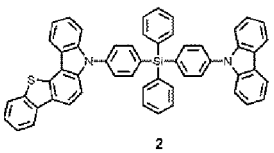
H-H103

[0072] In one embodiment, the amphiprotic host may be selected from group HEH1, but embodiments of the present disclosure are not limited thereto:

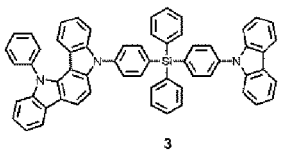
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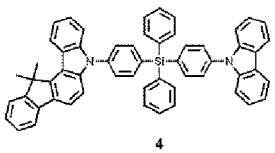
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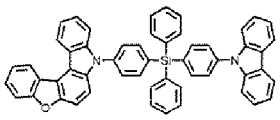
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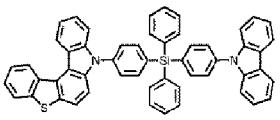


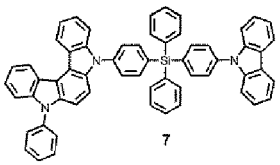
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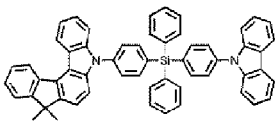


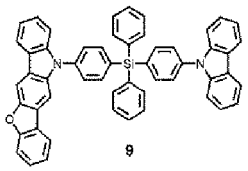
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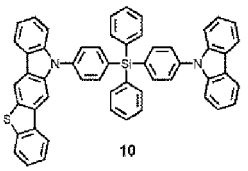

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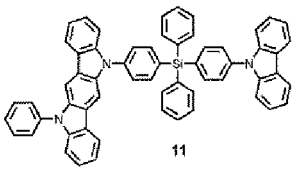

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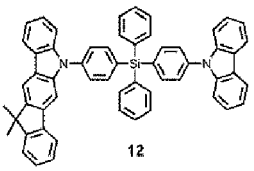

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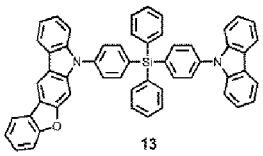

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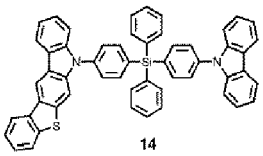

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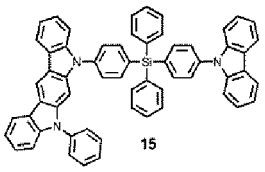

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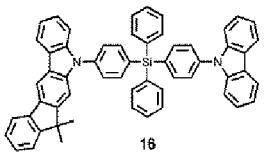

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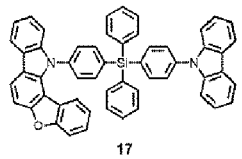

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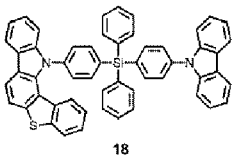

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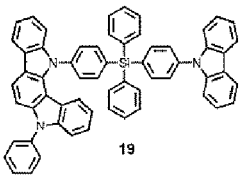

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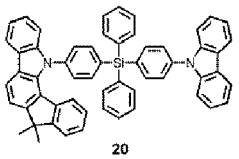

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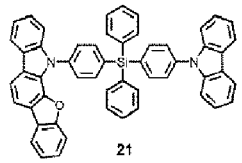

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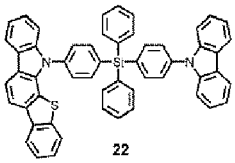

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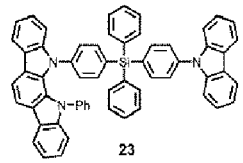

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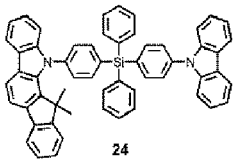

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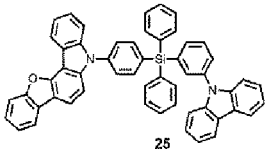

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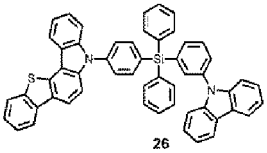

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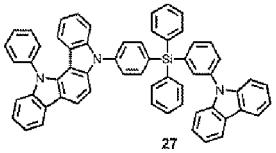


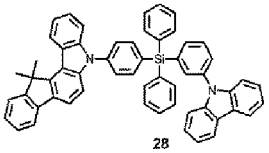
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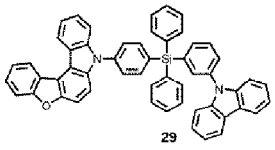

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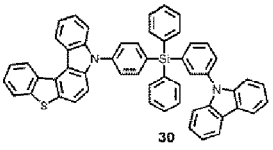

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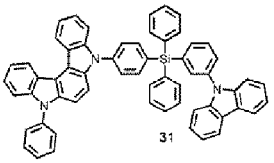

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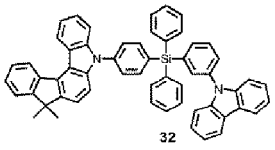

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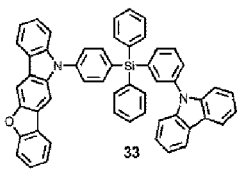

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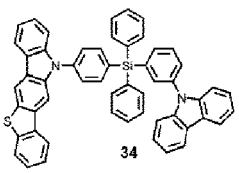

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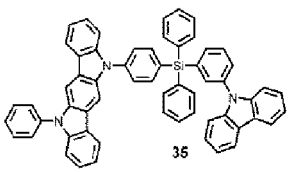

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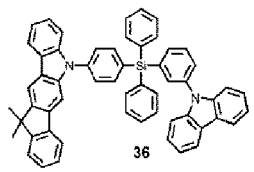

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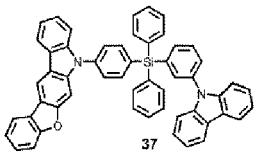

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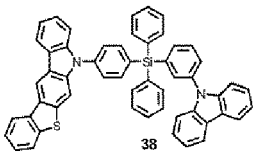

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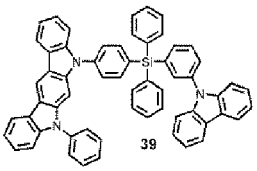

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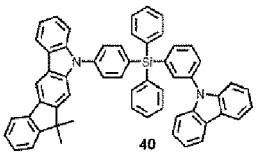

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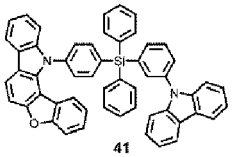

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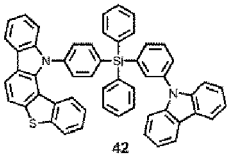

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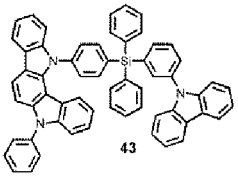

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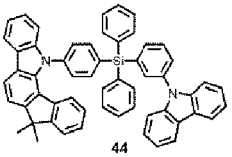

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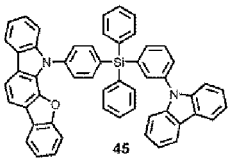

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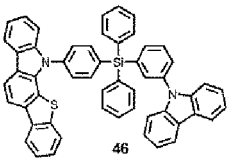

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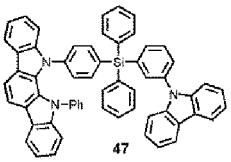

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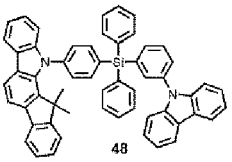

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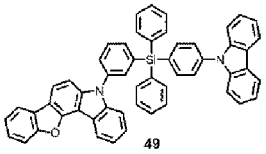

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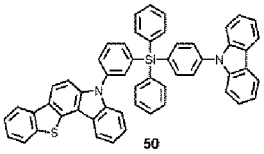

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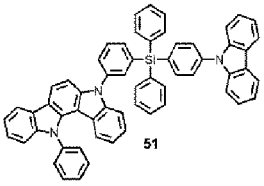

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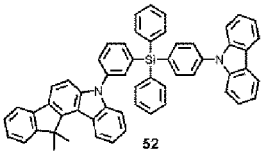

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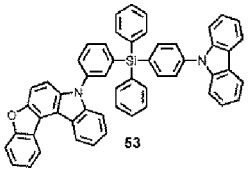

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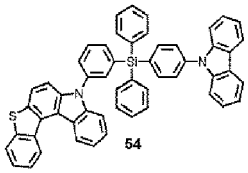

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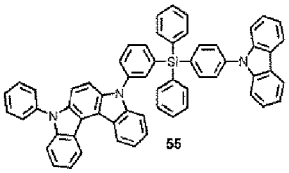

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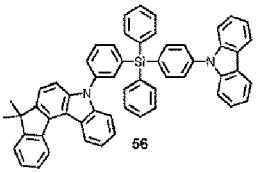

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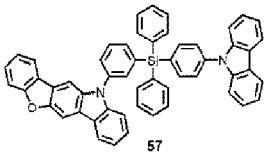

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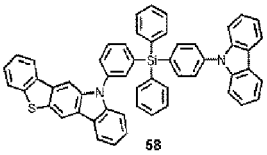

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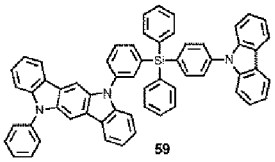

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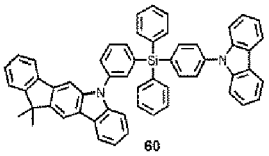

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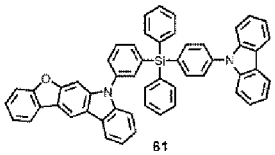

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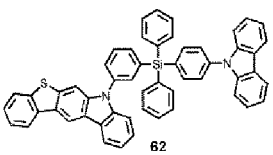

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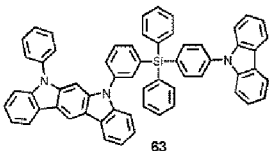

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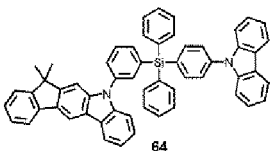

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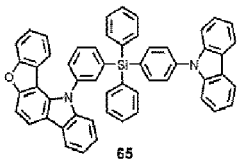

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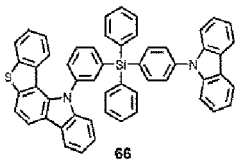

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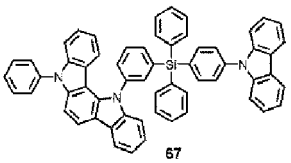

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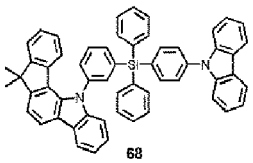

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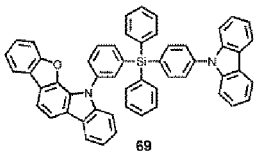

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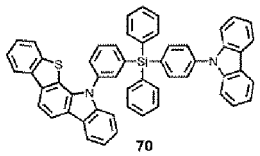

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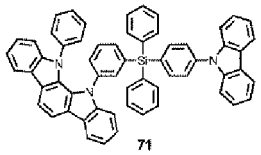

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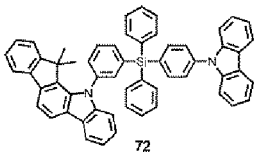

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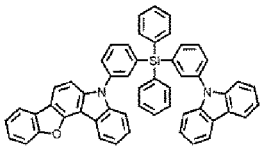

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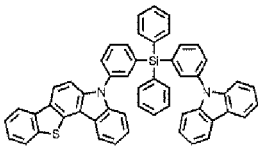

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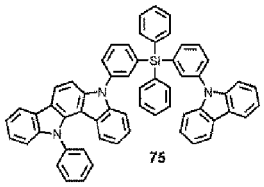

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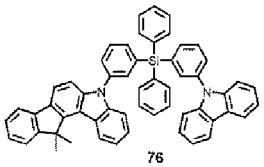

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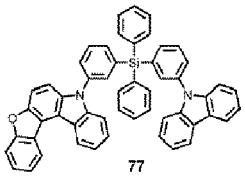

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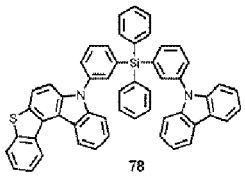

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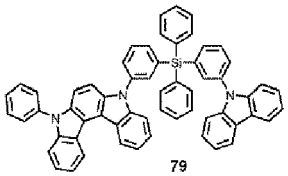

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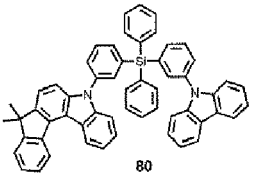

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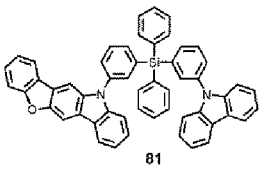

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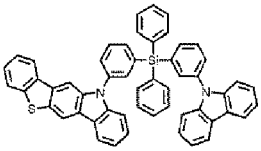

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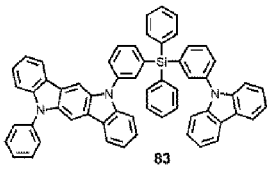

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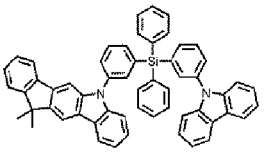

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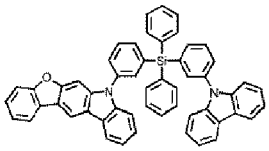

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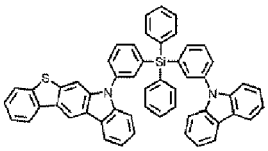

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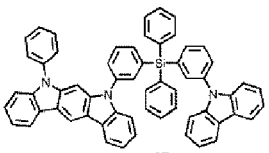

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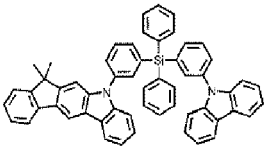

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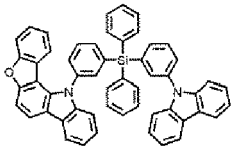

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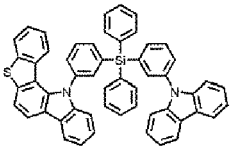

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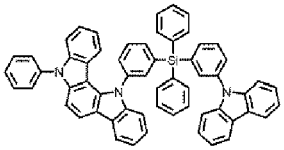

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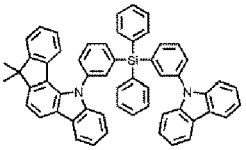

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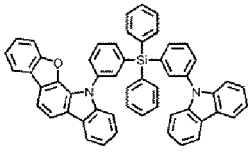

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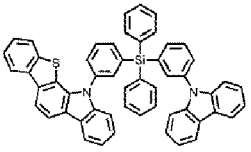

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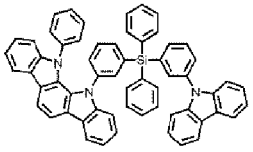

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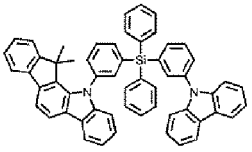

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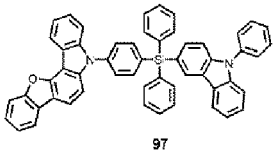

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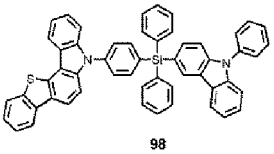

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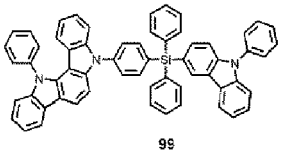

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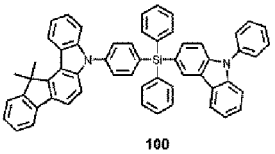

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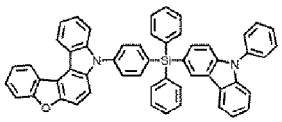

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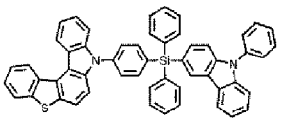

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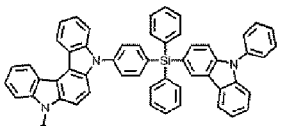

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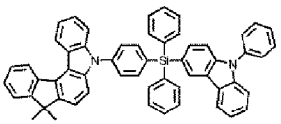

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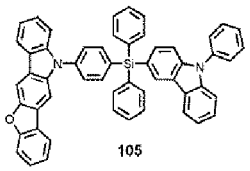

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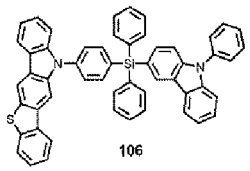

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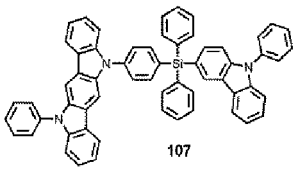

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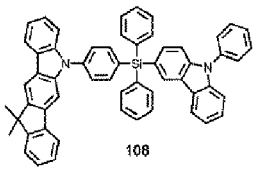

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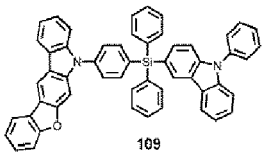

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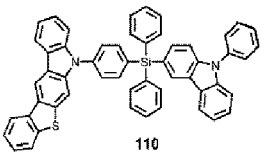

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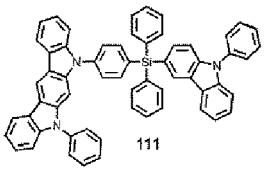

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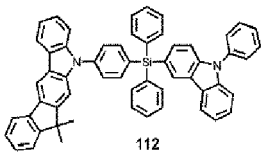

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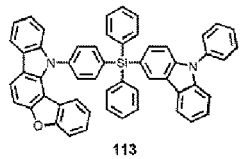

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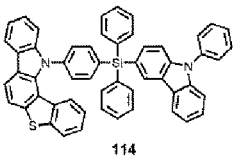

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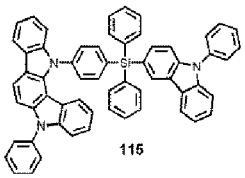

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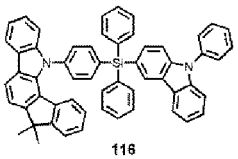

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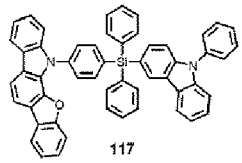

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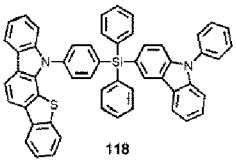

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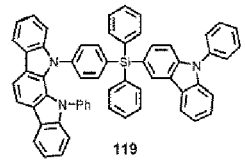

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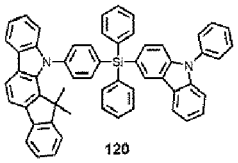

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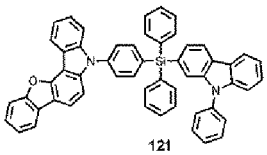

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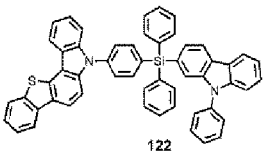

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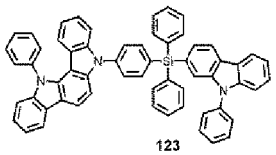


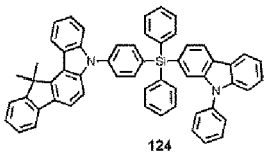
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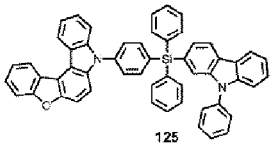

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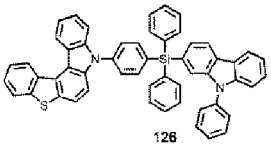

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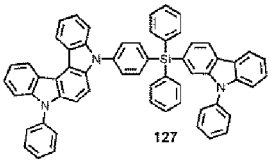

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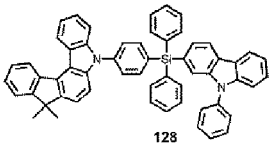

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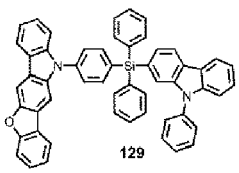

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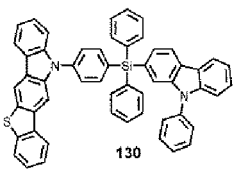

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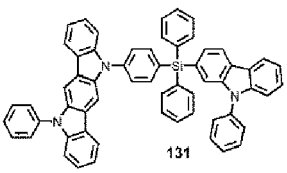

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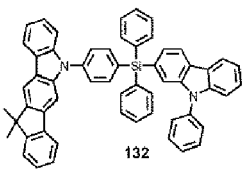

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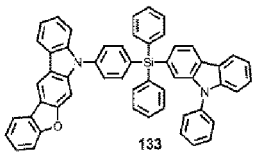

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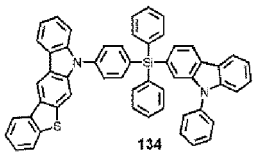

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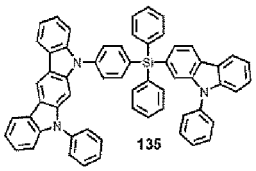

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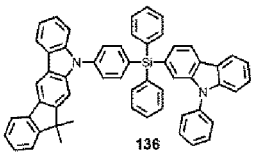

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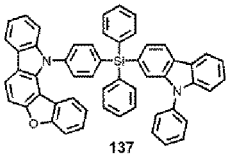

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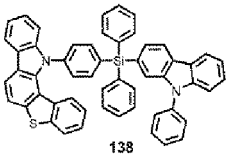

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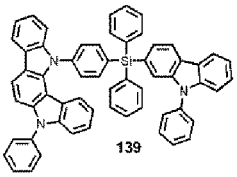

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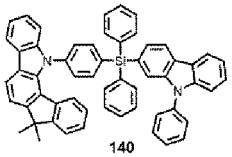

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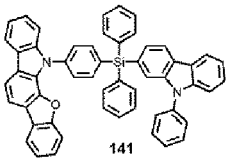

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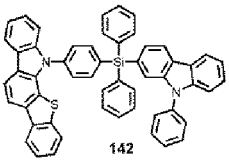

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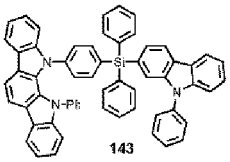

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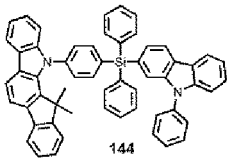

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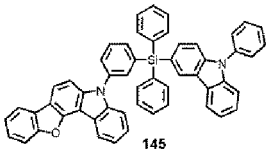

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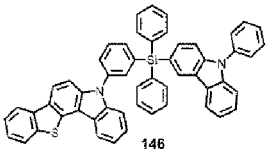

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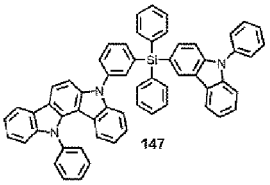

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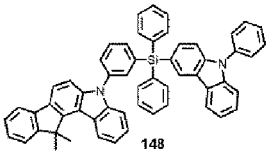

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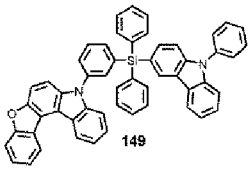

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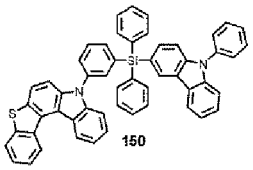

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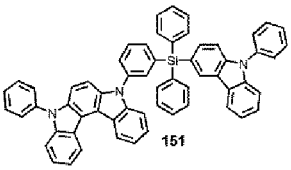

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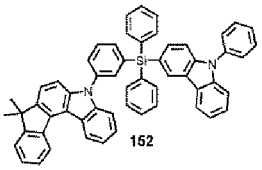

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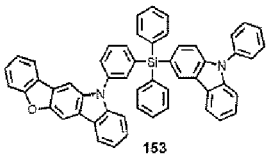

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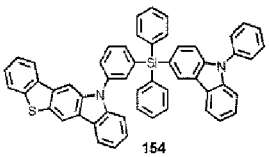

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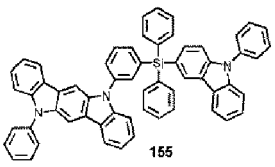

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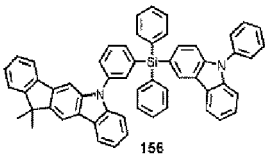

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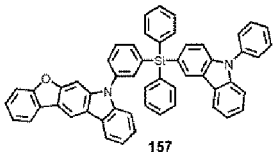

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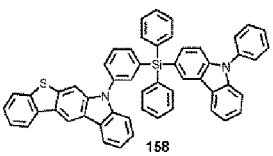

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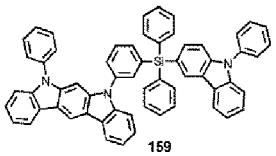

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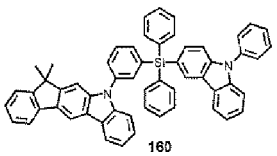

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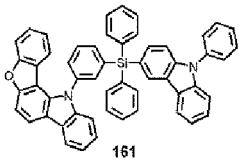

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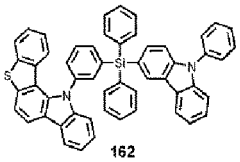

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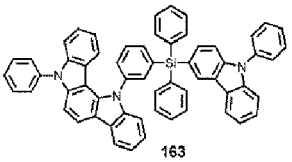

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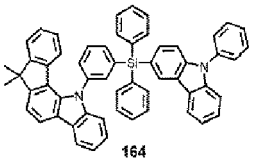

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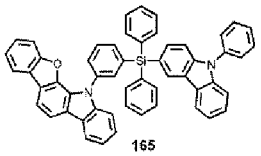

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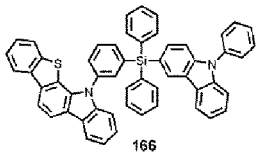

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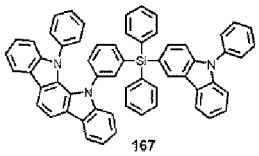

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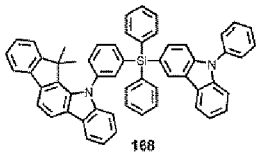

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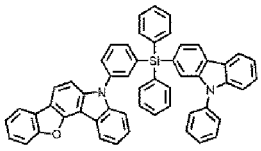

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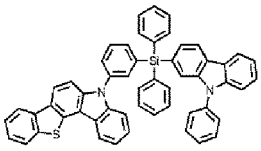

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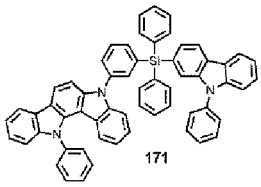

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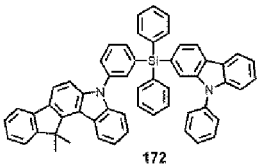

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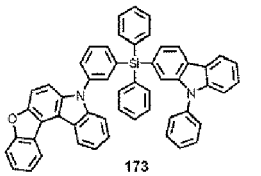

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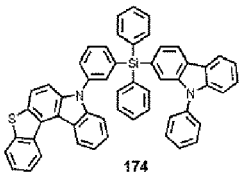

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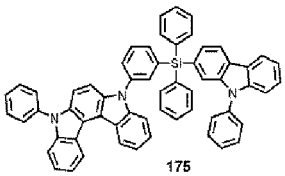

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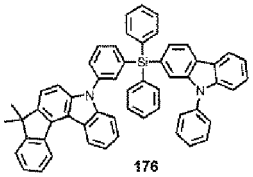

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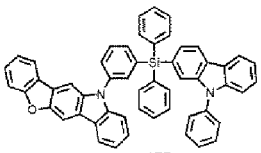

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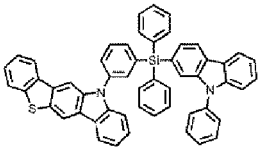

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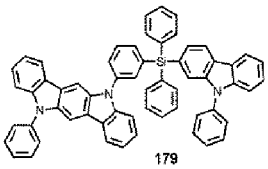

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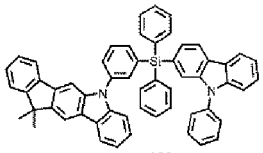

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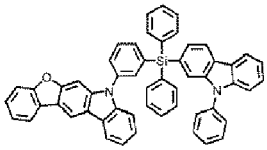

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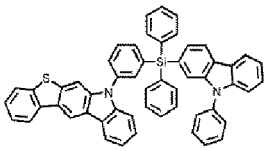

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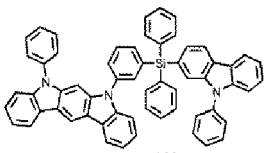

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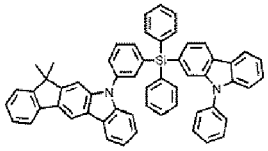

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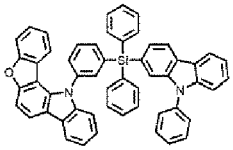

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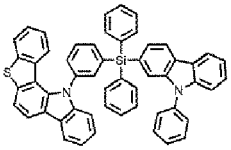

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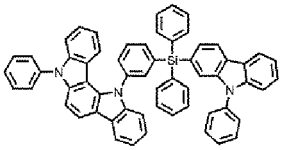

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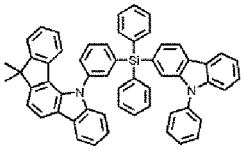

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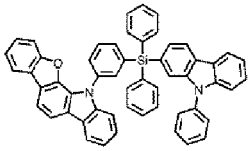

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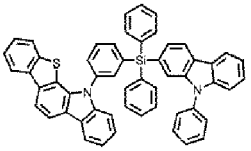

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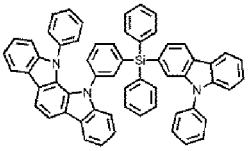

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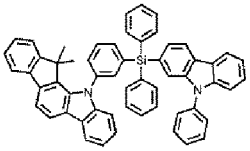

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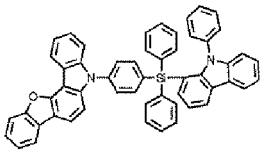

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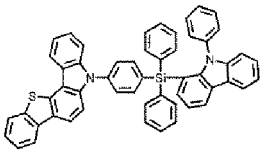

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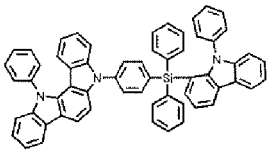

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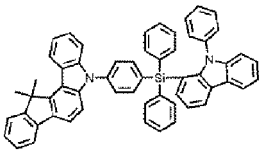

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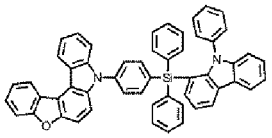

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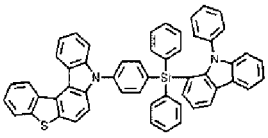

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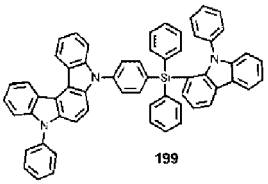

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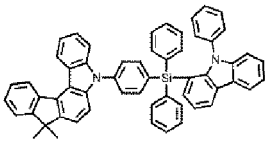

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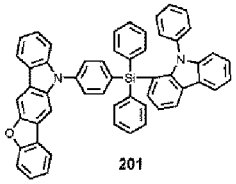

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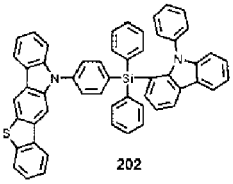

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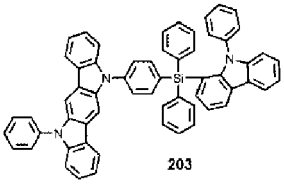

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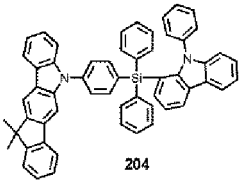

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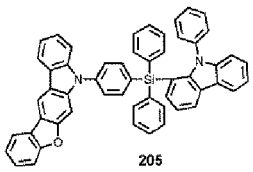

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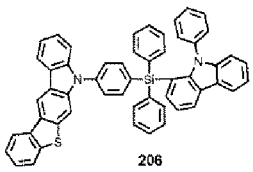

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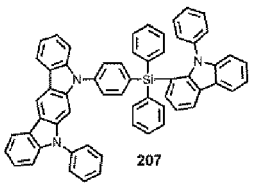

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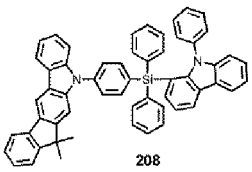

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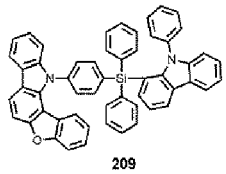

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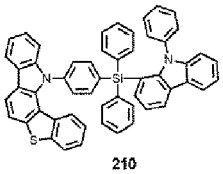

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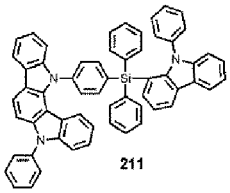

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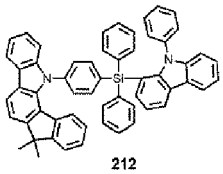

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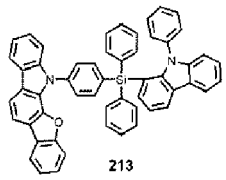

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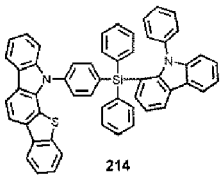

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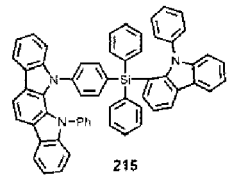

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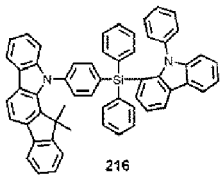

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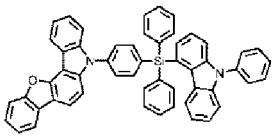

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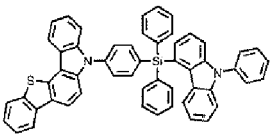

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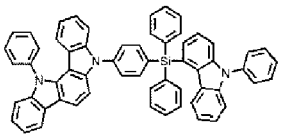

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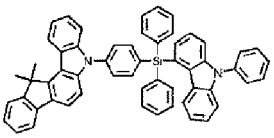

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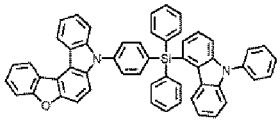

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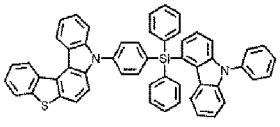

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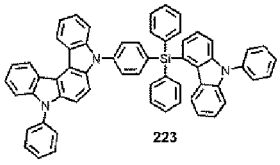

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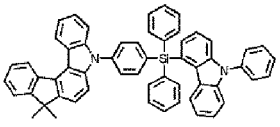

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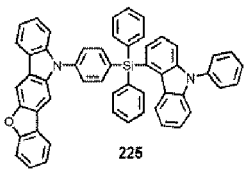

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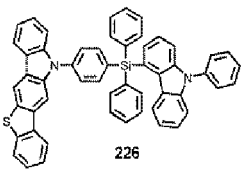

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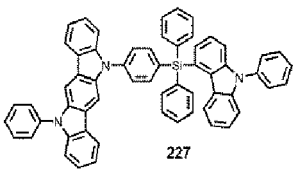

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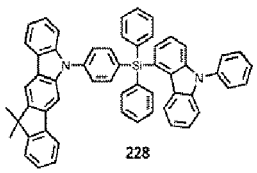

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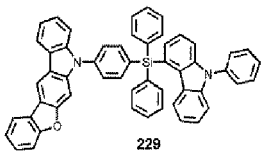

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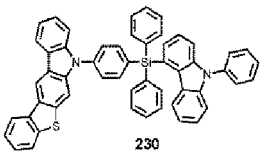

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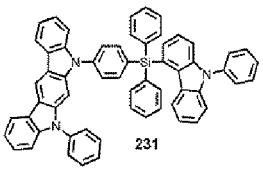

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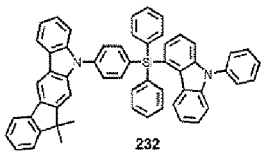

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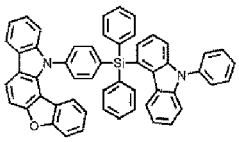

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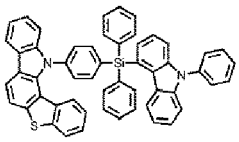

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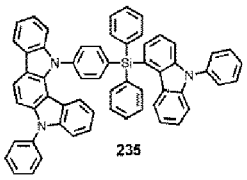

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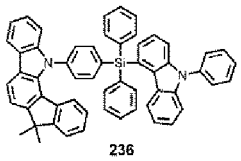

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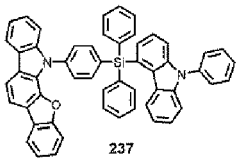

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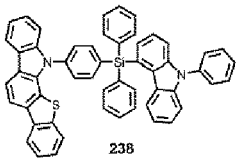

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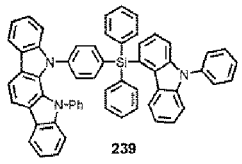

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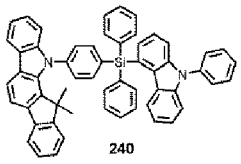

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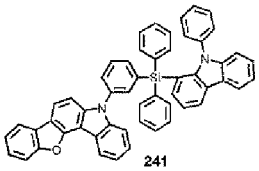

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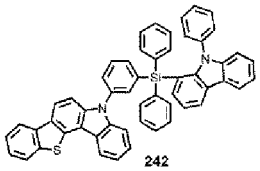

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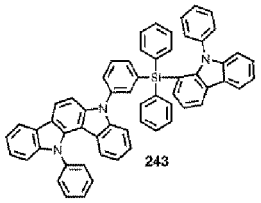


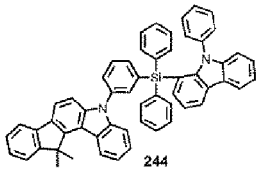
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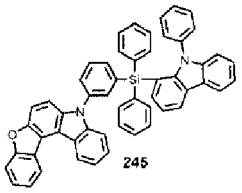

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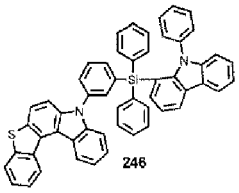

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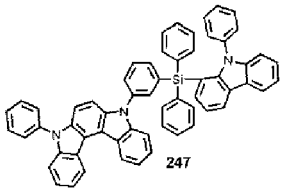

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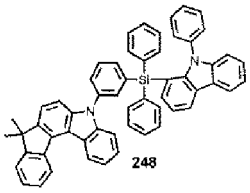

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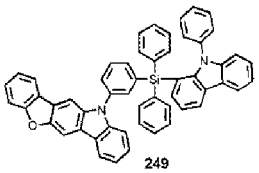

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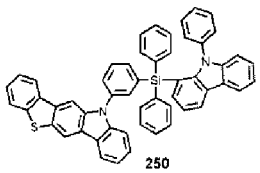

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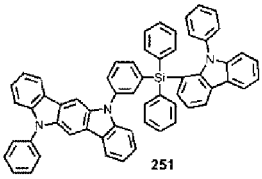

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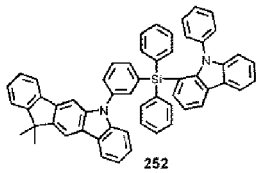

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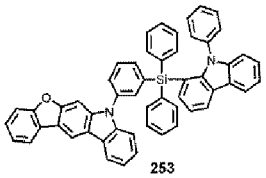

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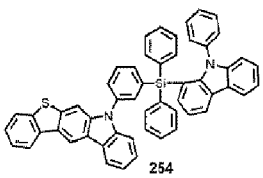

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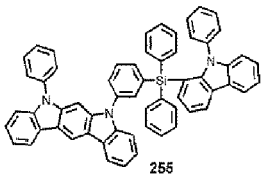

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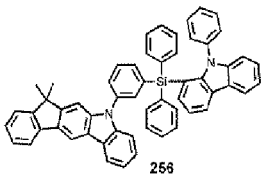

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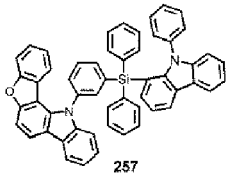

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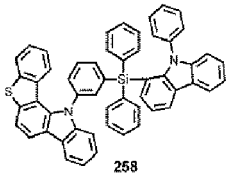

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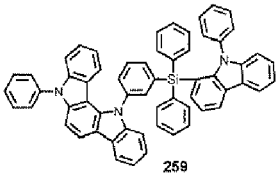

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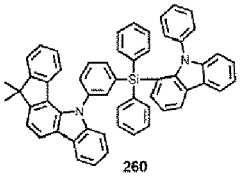

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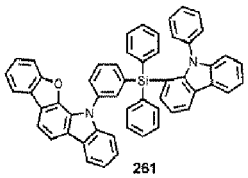

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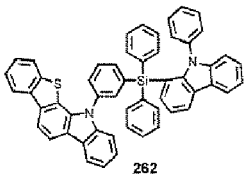

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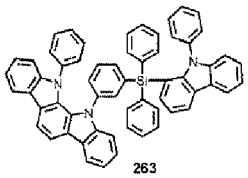

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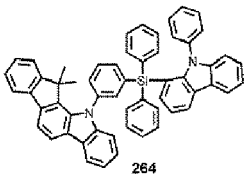

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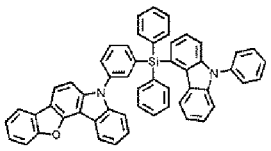

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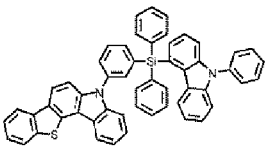

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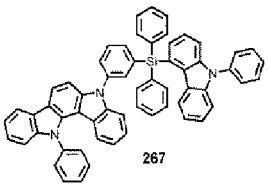

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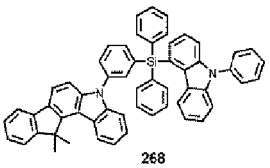

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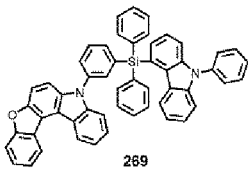

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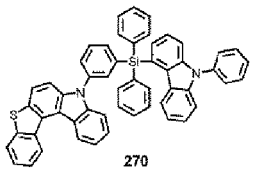

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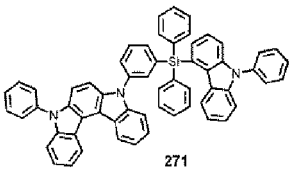

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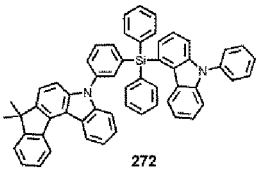

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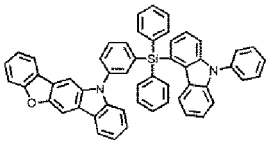

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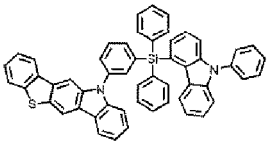

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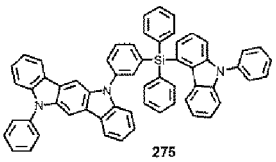

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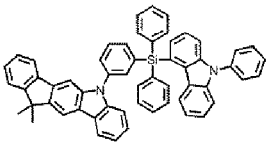

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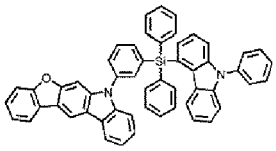

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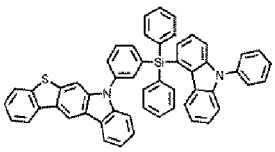

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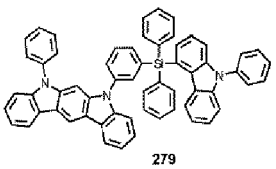

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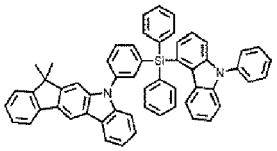

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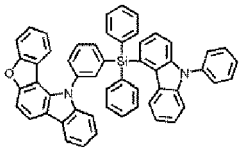

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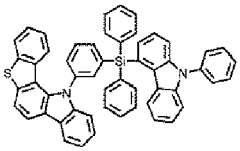

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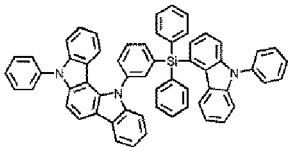

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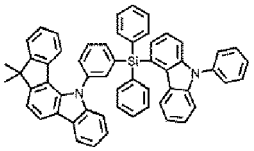

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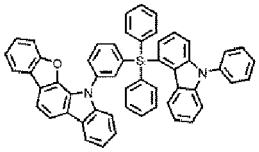

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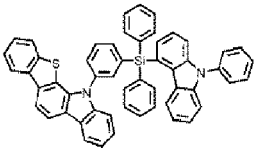

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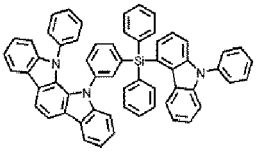

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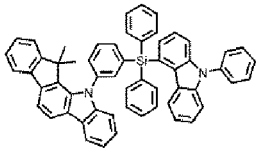

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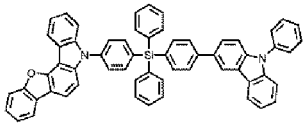

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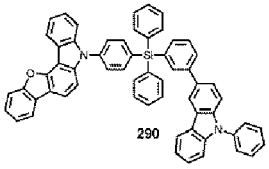

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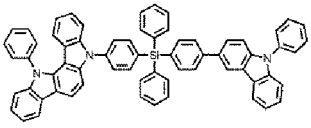

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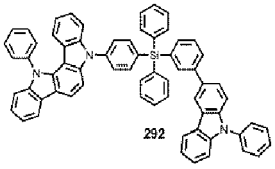

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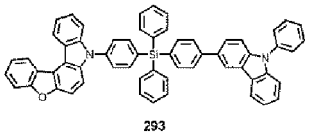

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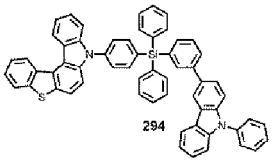

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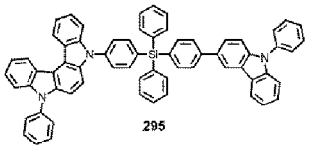

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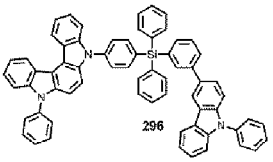

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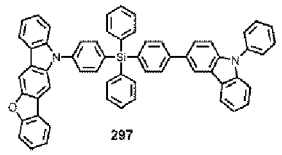

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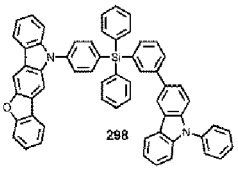

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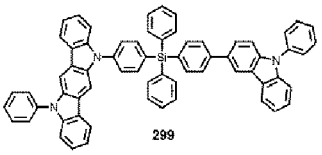

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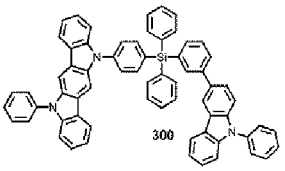

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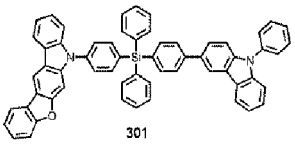

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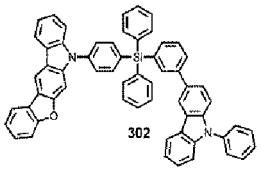

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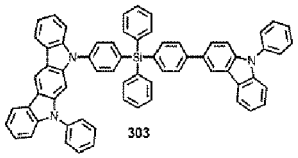

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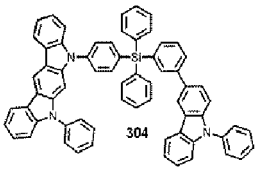

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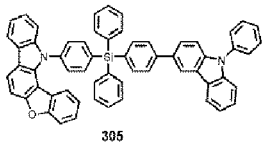

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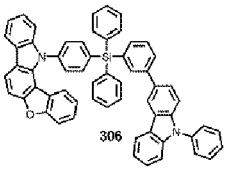

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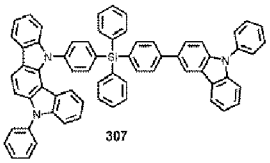

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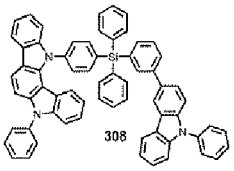

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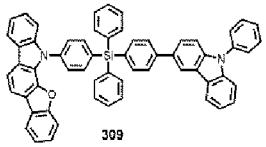

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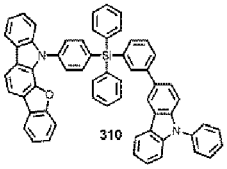

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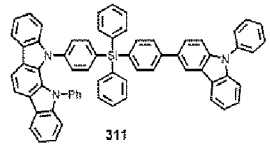

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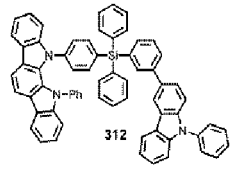

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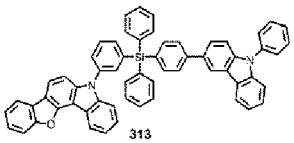

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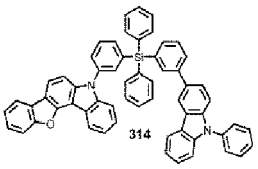

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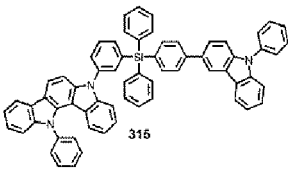

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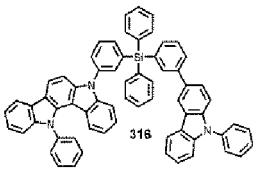

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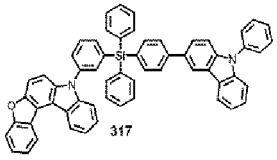

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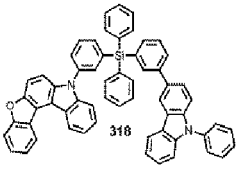

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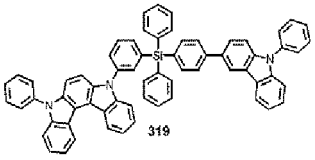

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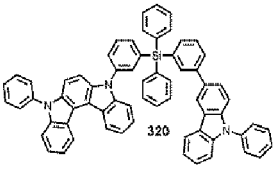

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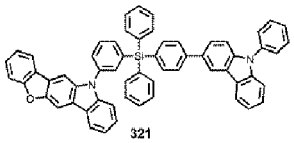

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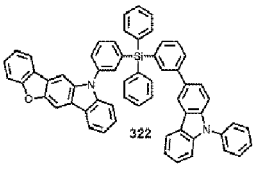

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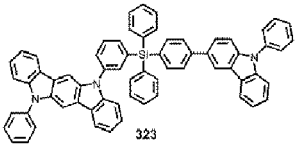

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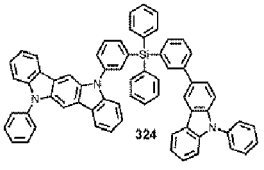

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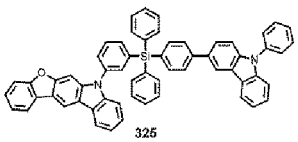

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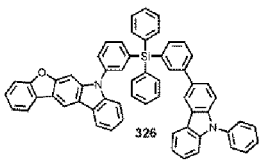

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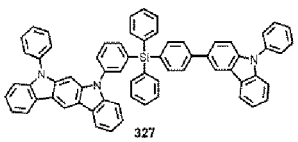

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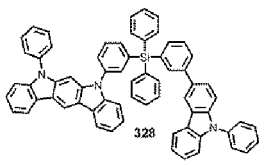

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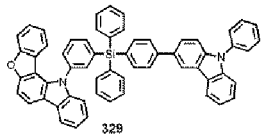

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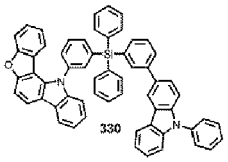

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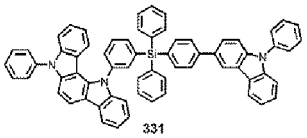

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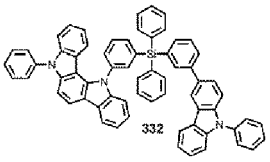

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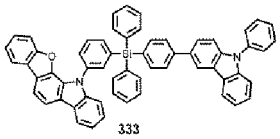

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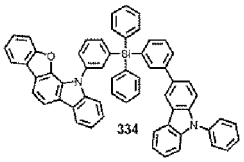

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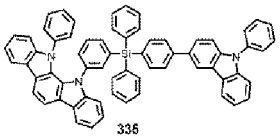

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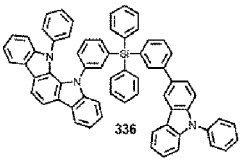

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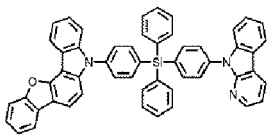

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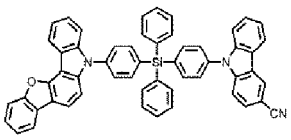

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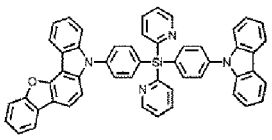

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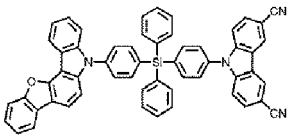

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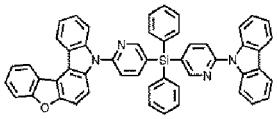

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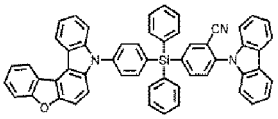

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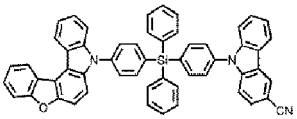

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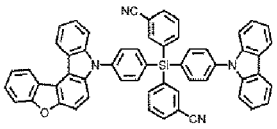

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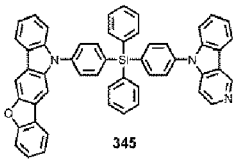

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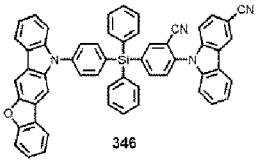

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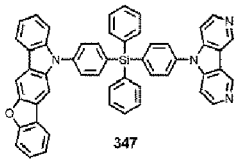

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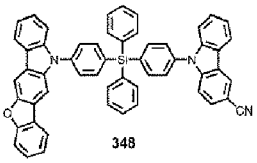

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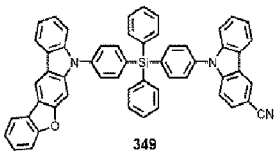

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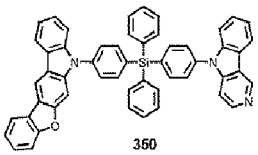

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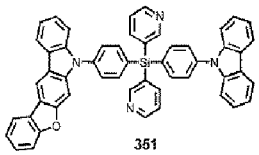

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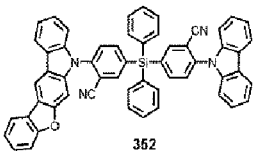

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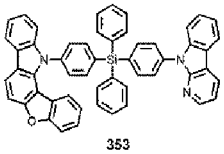

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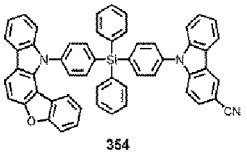

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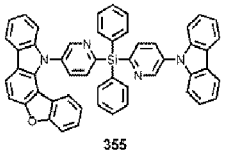

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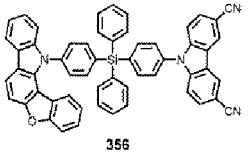

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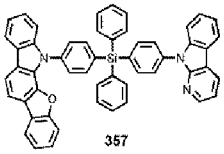

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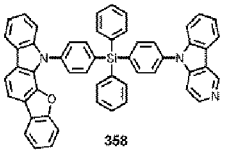

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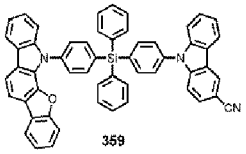

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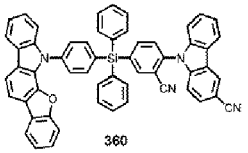

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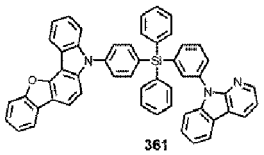

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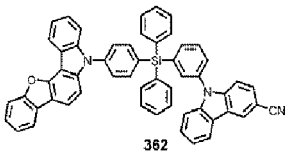

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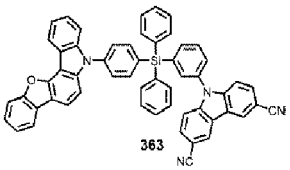

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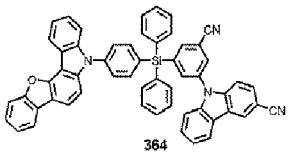

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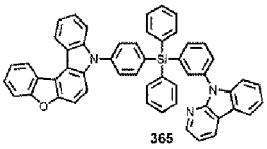

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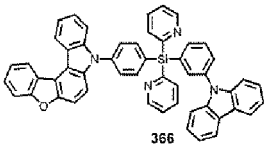

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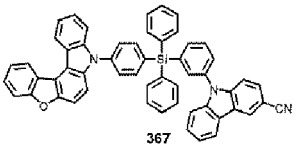

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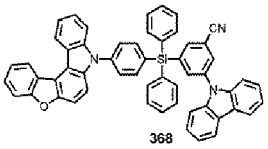

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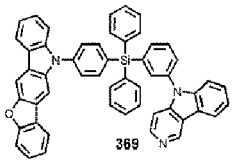

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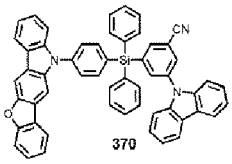

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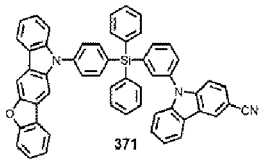

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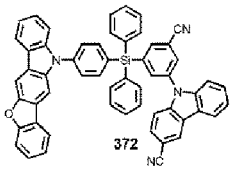

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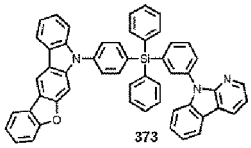

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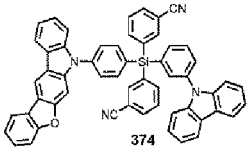

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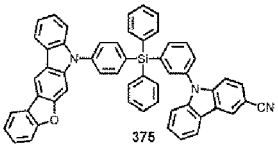

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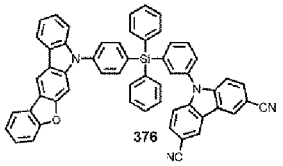

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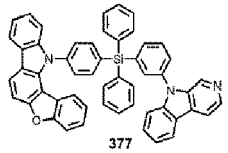

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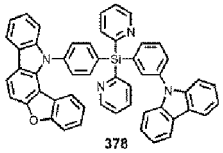

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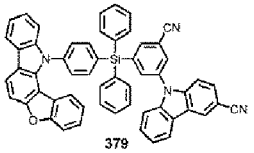

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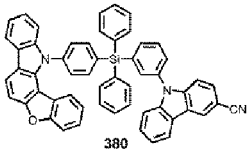

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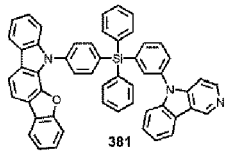

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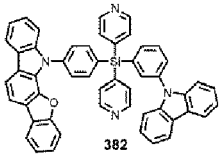

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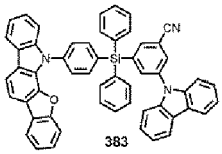

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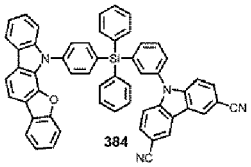

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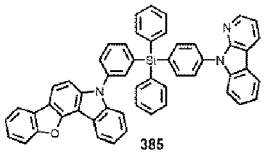

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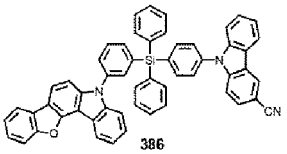

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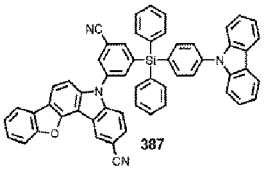

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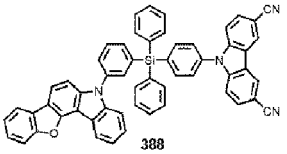

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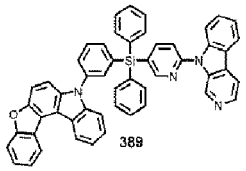

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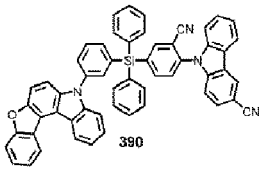

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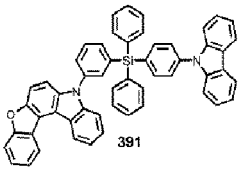

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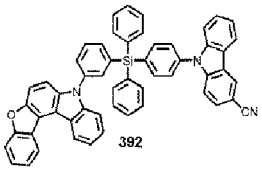

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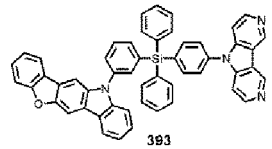

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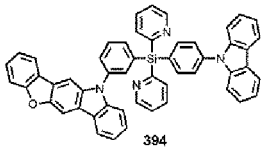

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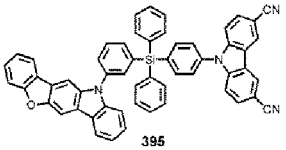

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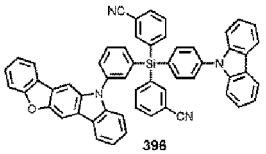

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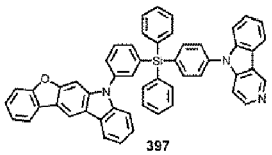

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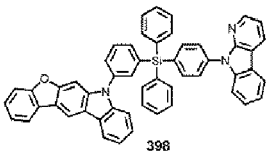

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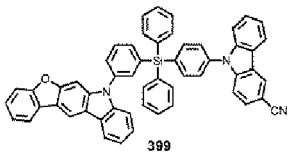

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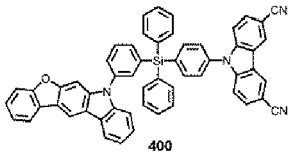

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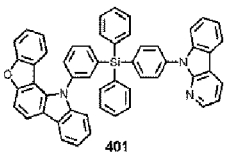

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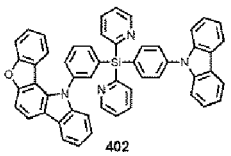

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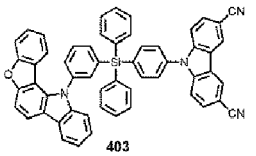

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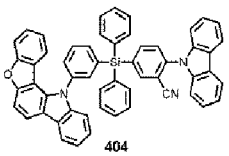

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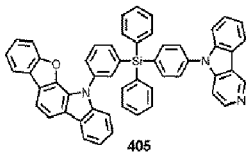

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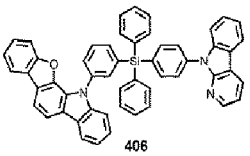

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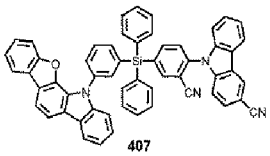

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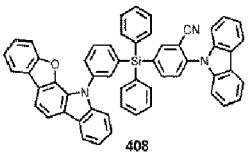

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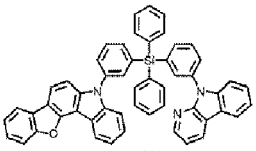

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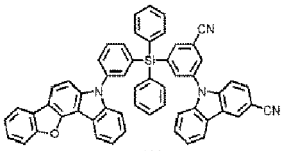

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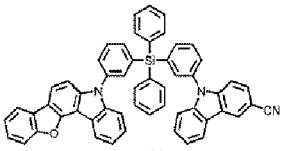

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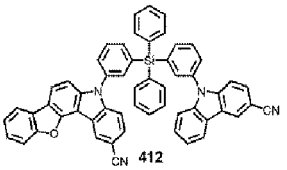

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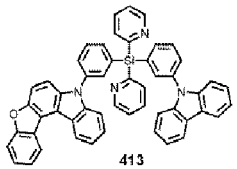

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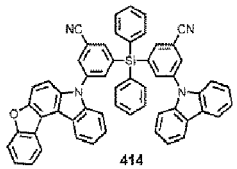

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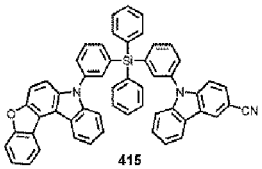

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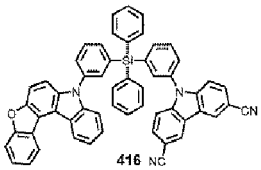

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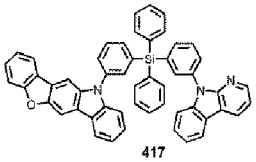

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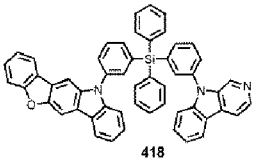

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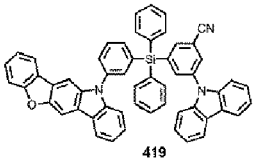

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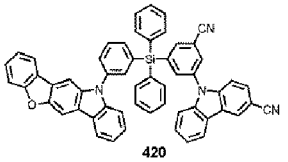

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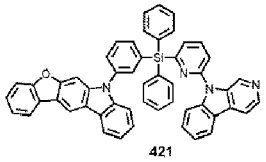

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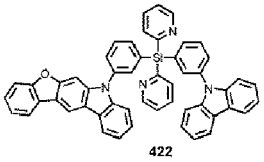

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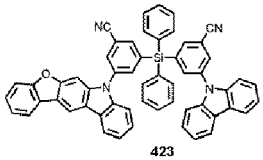

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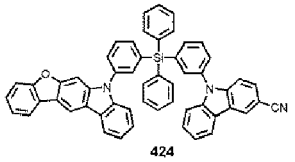

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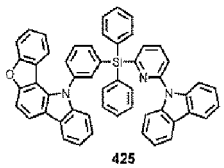

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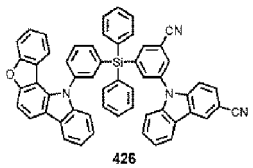

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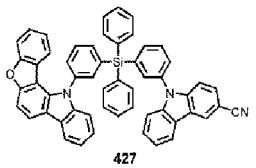

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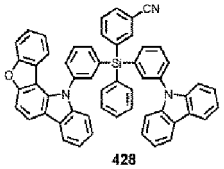

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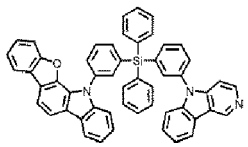

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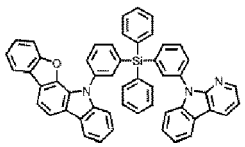

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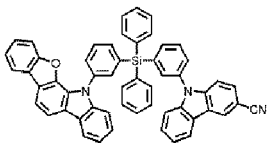

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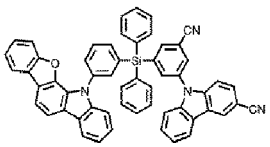

427


428


429


430


431


432

wherein, in Compounds 1 to 432,
Ph may be a phenyl group.

[0073] When the host is a mixture of an electron transport host and a hole transport host, the weight ratio of the electron transport host and hole transport host may be 1: 9 to 9: 1, for example, 2: 8 to 8: 2, for example, 4: 6 to 6: 4, for example, 5: 5. When the weight ratio of the electron transport host and the hole transport host satisfies the above-described ranges, the hole-and-electron transport balance in the emission layer 15 may be made.

[Cooling dopant in emission layer 15]

[0074] Since the cooling dopant emits fluorescent light, organic light-emitting devices according to an embodiment of the present disclosure are clearly distinguished from organic light-emitting devices containing compounds that emit phosphorescent light.

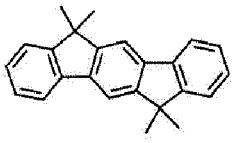
[0075] The cooling dopant satisfies Condition 2, as described above.

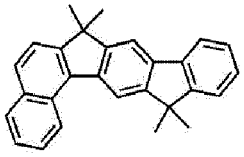
[0076] The maximum emission wavelength of the emission spectrum of the cooling dopant may be 400 nm or more and 550 nm or less. For example, the maximum emission wavelength of the emission spectrum of the cooling dopant may be 400 nm or more and 495 nm or less, or 450 nm or more and 495 nm or less, but embodiments of the present disclosure are not limited thereto. In other words, the cooling dopant may emit blue light. The "maximum emission wavelength" refers to a wavelength at which the emission intensity is the greatest, and may also be referred to as "a peak emission wavelength".

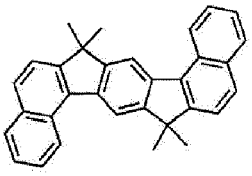
[0077] In an embodiment, the cooling dopant may not include metal atoms.

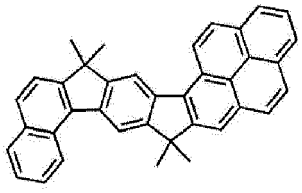
[0078] In an embodiment, the cooling dopant may be selected from a condensed polycyclic compound and a styryl-based compound.

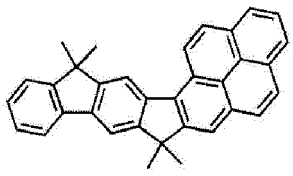
[0079] For example, the cooling dopant may include one of a naphthalene-containing core, a fluorene-containing core, a spiro-bifluorene-containing core, a benzofluorene-containing core, a dibenzofluorene-containing core, a phenanthrene-containing core, an anthracene-containing core, a fluoranthene-containing core, a triphenylene-containing core, a pyrene-containing core, a chrysene-containing core, a naphthacene-containing core, a picene-containing core, a perylene-containing core, a pentaphene-containing core, an indenoanthracene-containing core, a bisanthracene-containing core, and cores represented by Formulae 501-1 to 501-18, but embodiments of the present disclosure are not limited thereto:

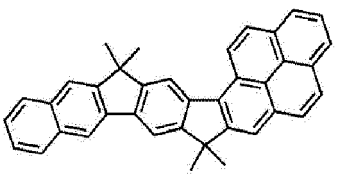

501-1

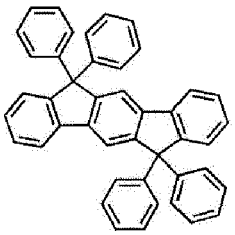

501-2


501-3

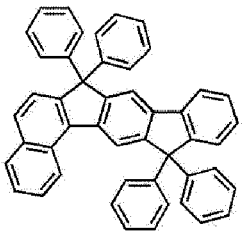

501-4


501-5

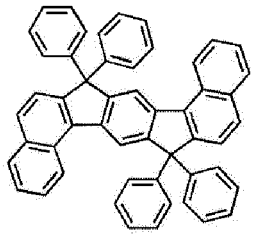

501-6



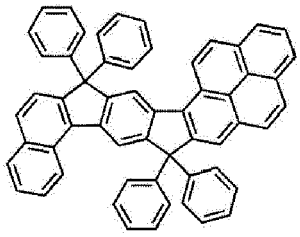
501-7



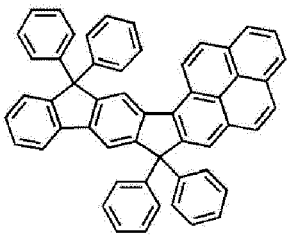
501-8



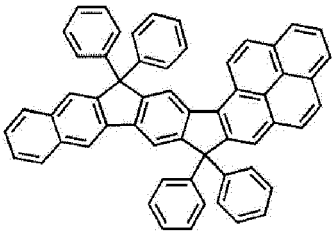
501-9



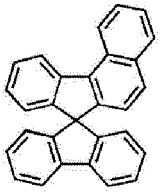
501-10



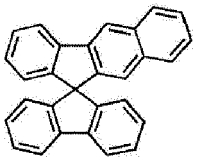
501-11



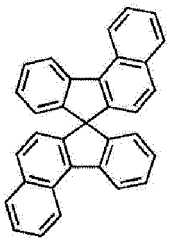
501-12



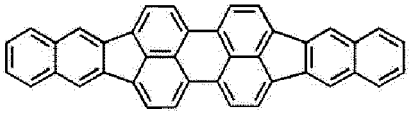
501-13



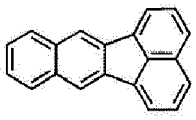
501-14



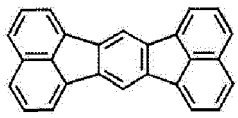
501-15



501-16



501-17

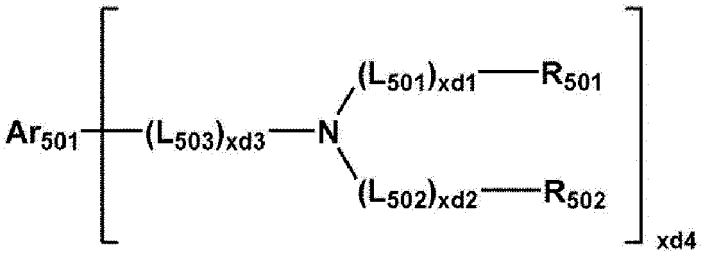


501-18

[0080] In one or more embodiments, the cooling dopant may be selected from a styryl-amine-based compound and a styryl-carbazole-based compound, but embodiments of the present disclosure are not limited thereto.

[0081] In one embodiment, the cooling dopant may be selected from compounds represented by Formula 501:

<Formula 501>



[0082] In Formula 501,

Ar_{501} may be selected from:

a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a bisanthracene group, and groups represented by Formulae 501-1 to 501-18; and

a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a bisanthracene group, and groups represented by Formulae 501-1 to 501-18, each substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10}heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group and -Si(Q_{501})(Q_{502})(Q_{503}) (wherein Q_{501} to Q_{503} may each independently be selected from hydrogen, C_1-C_{60} alkyl group, a C_1-C_{60} alkoxy group, a C_6-C_{60} aryl group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, and a monovalent non-aromatic condensed heteropolycyclic group);

L_{501} to L_{503} may each independently be selected from a substituted or unsubstituted C_3-C_{10} cycloalkylene group, a substituted or unsubstituted C_1-C_{10} heterocycloalkylene group, a substituted or unsubstituted C_3-C_{10} cycloalkenylene group, a substituted or unsubstituted C_1-C_{10} heterocycloalkenylene group, a substituted or unsubstituted C_6-C_{60} arylene group, a substituted or unsubstituted C_1-C_{60} heteroarylene group, a substituted or unsubstituted divalent non-aromatic condensed polycyclic group, and a substituted or unsubstituted divalent non-aromatic condensed heteropolycyclic group,

R_{501} to R_{508} may each independently be selected from:

a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a pyrenyl group, a chrysenyl group, a pyridinyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a quinolinyl group, an isoquinolinyl group, a quinoxalinyl group, a quinazolinyl group, a carbazole group, a triazinyl group, a dibenzofuranyl group, and a dibenzothiophenyl group; and

a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a pyrenyl group, a chrysenyl group, a pyridinyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a quinolinyl group, an isoquinolinyl group, a quinoxalinyl group, a quinazolinyl group, a carbazolyl group, a triazinyl group, a dibenzofuranyl group, and a dibenzothiophenyl group, each substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a pyrenyl group, a chrysenyl group, a pyridinyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a quinolinyl group, an isoquinolinyl group, a quinoxalinyl group, a quinazolinyl group, a carbazolyl group, a triazinyl group, a dibenzofuranyl group, and a dibenzothiophenyl group,

xd1 to xd3 may each independently be selected from 0, 1, 2, and 3, and

xd4 may be selected from 0, 1, 2, 3, 4, 5, and 6.

[0083] For example, in Formula 501,

Ar_{501} may be selected from:

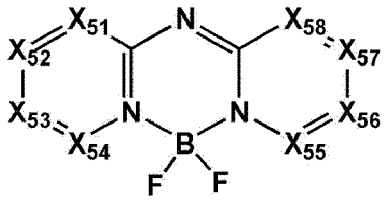
a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a bisanthracene group, and groups represented by Formulae 501-1 to 501-18; and

a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a bisanthracene group, and groups represented by Formula 501-1 to 501-18, each substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino

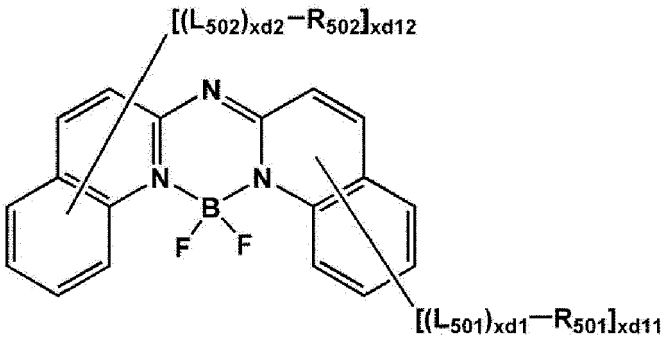
group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a carbazolyl group, a pyridinyl group, a pyrimidinyl group, a triazinyl group, a quinolinyl group, an isoquinolinyl group and $-Si(Q_{501})(Q_{502})(Q_{503})$ (Q_{501} to Q_{503} may each independently be selected from hydrogen, C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, and a naphthyl group),
xd1 to xd3 may each independently be selected from 0, 1, and 2, and
xd4 may be selected from 0, 1, 2, and 3, but embodiments of the present disclosure are not limited thereto.

[0084] In one or more embodiments, the cooling dopant may include a compound represented by one of Formulae 502-1 to 502-5:

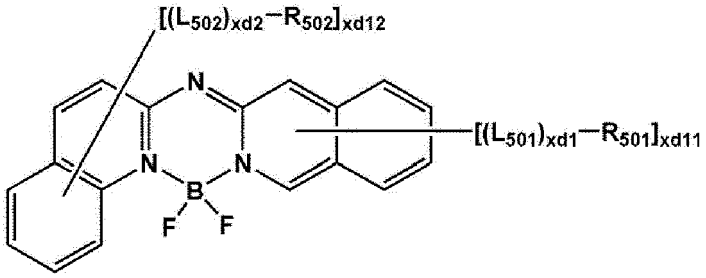
<Formula 502-1>



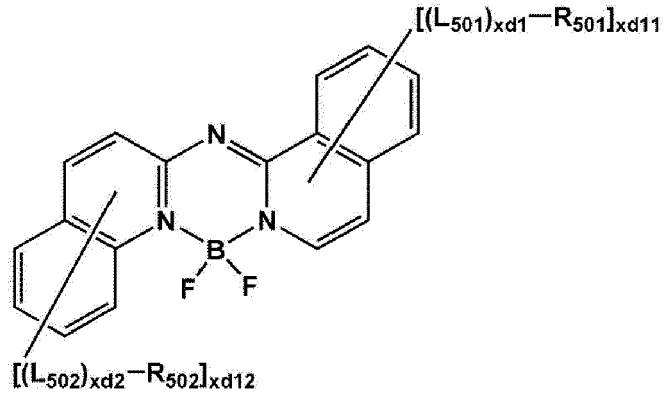
<Formula 502-2>



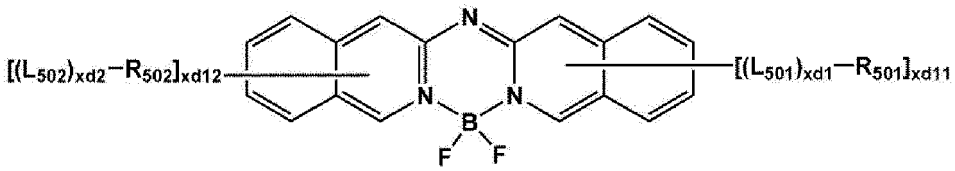
<Formula 502-3>



<Formula 502-4>



<Formula 502-5>

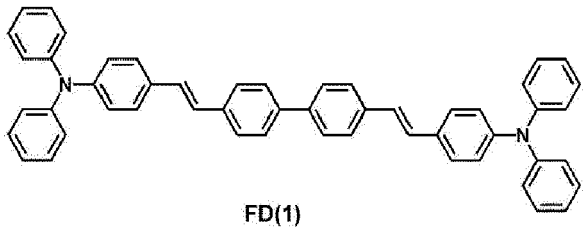


wherein, in Formulae 502-1 to 502-5,

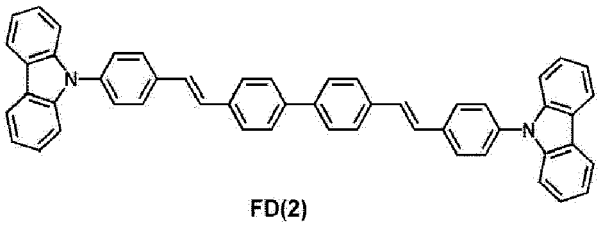
X_{51} may be N or C-[$(L_{501})_{xd1}$-R_{501}], X_{52} may be N or C-[$(L_{502})_{xd2}$-R_{502}], X_{53} may be N or C-[$(L_{503})_{xd3}$-R_{503}], X_{54} may be N or C-[$(L_{504})_{xd4}$-R_{504}], X_{55} may be N or C-[$(L_{505})_{xd5}$-R_{505}], X_{56} may be N or C-[$(L_{506})_{xd6}$-R_{506}], X_{57} may be N or C-[$(L_{507})_{xd7}$-R_{507}], and X_{58} may be N or C-[$(L_{508})_{xd8}$-R_{508}],
L_{501} to L_{508} are each the same as described in connection with L_{501} in Formula 501,
xd1 to xd8 are each the same as described in connection with xd1 in Formula 501,
R_{501} to R_{508} may each independently be selected from:

hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group,
a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a pyrenyl group, a chrysenyl group, a pyridinyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a quinolinyl group, an isoquinolinyl group, a quinoxalinyl group, a quinazolinyl group, a carbazole group, a triazinyl group, a dibenzofuranyl group, and a dibenzothiophenyl group; and
a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a pyrenyl group, a chrysenyl group, a pyridinyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a quinolinyl group, an isoquinolinyl group, a quinoxalinyl group, a quinazolinyl group, a carbazolyl group, a triazinyl group, a dibenzofuranyl group, and a dibenzothiophenyl group, each substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a pyrenyl group, a chrysenyl group, a pyridinyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a quinolinyl group, an isoquinolinyl group, a quinoxalinyl group, a quinazolinyl group, a carbazolyl group, a triazinyl group, a dibenzofuranyl group, and a dibenzothiophenyl group,
xd11 and xd12 may each independently be an integer from 0 to 5, and
two of R_{501} to R_{504} may optionally be linked together to form a saturated or unsaturated ring, and
two of R_{505} to R_{508} may optionally be linked together to form a saturated or unsaturated ring.

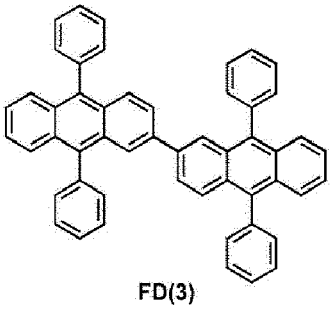
[0085] The cooling dopant may include at least one compound selected from, for example, the following compounds FD(1) to FD(16) and FD1 to FD18:



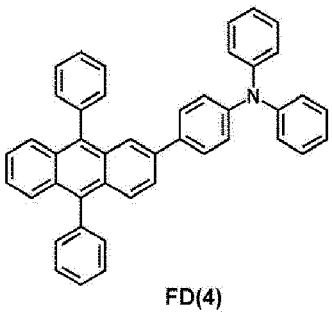
FD(1)



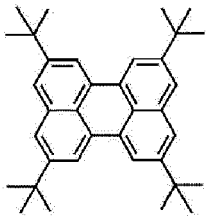
FD(2)



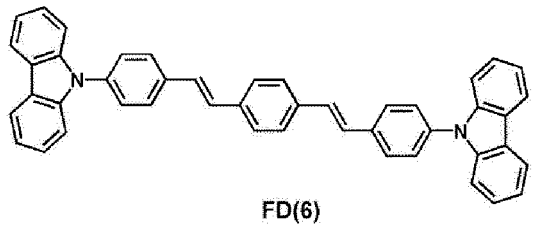
FD(3)



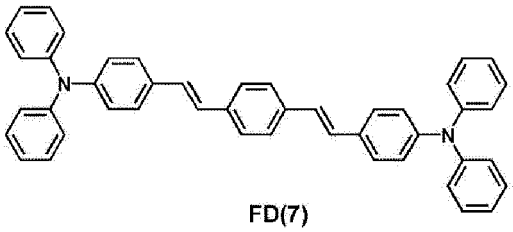
FD(4)



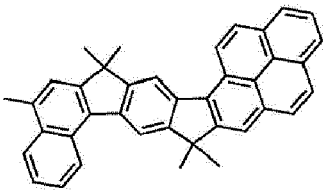
FD(5)



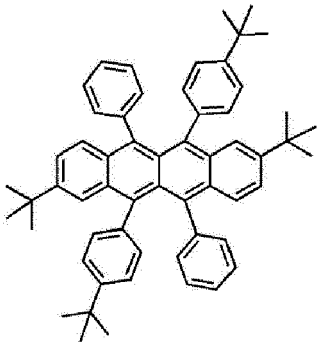
FD(6)



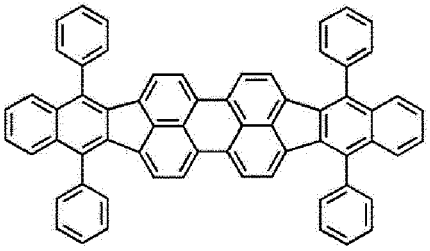
FD(7)



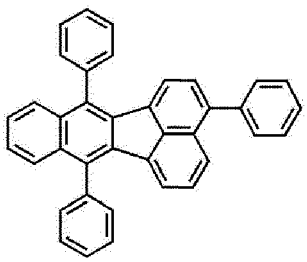
FD(8)



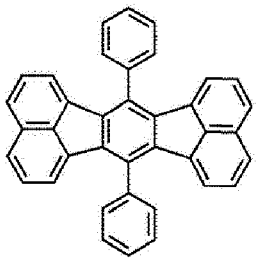
FD(9)



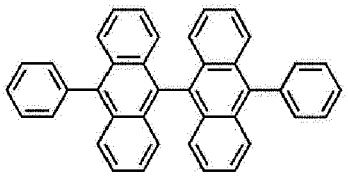
FD(10)



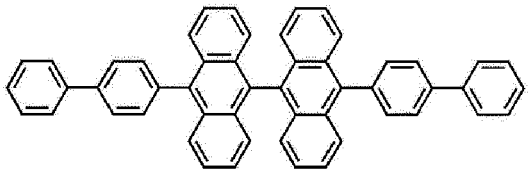
FD(11)



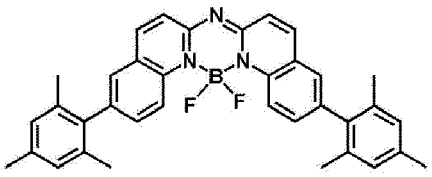
FD(12)



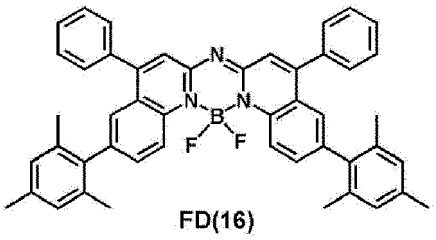
FD(13)



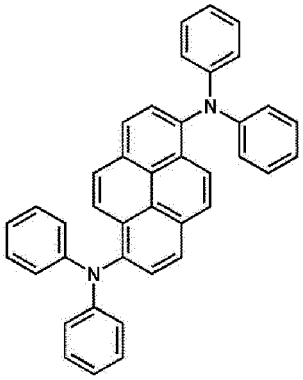
FD(14)



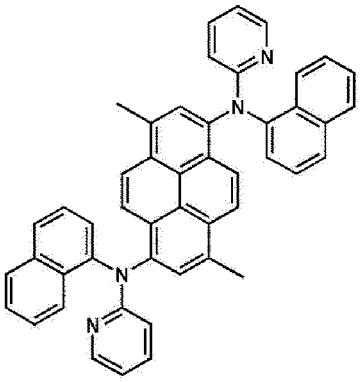
FD(15)



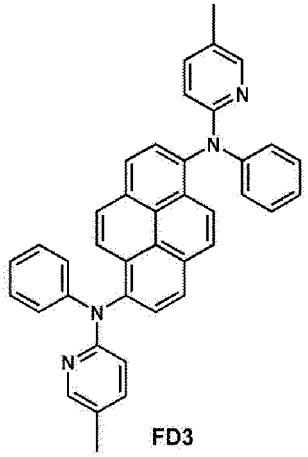
FD(16)



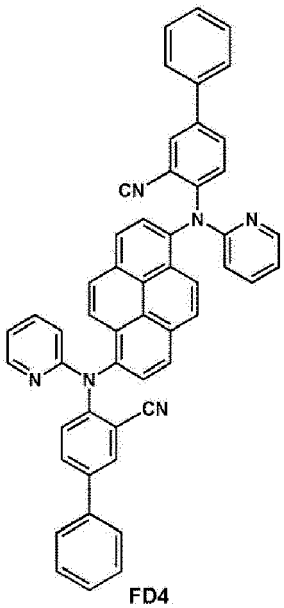
FD1



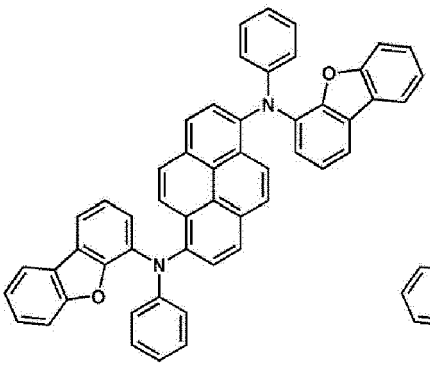
FD2



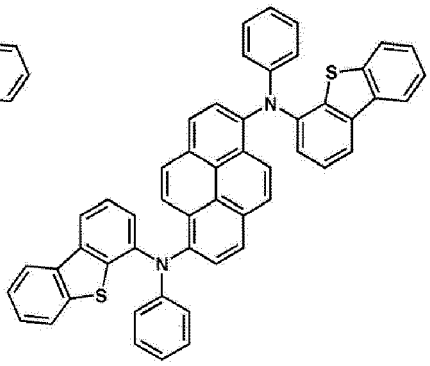
FD3



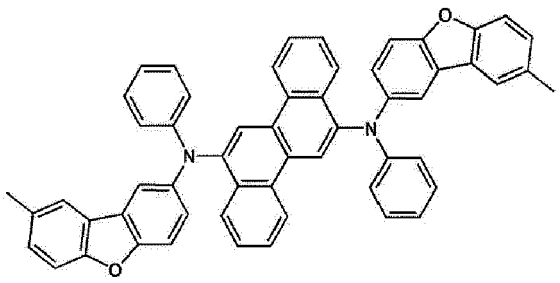
FD4



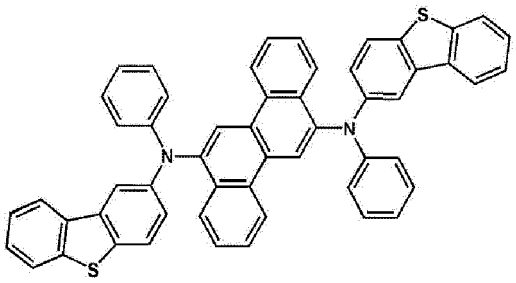
FD5



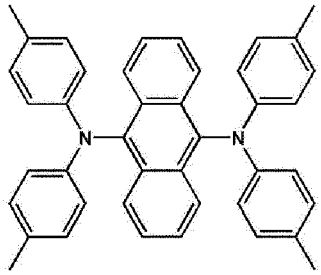
FD6



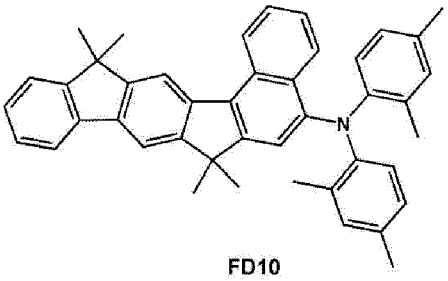
FD7



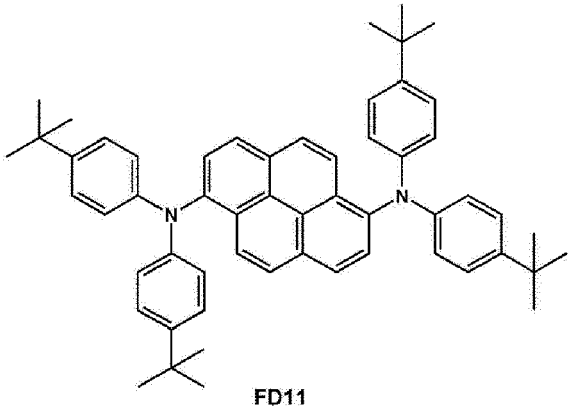
FD8



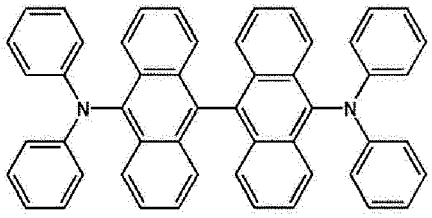
FD9



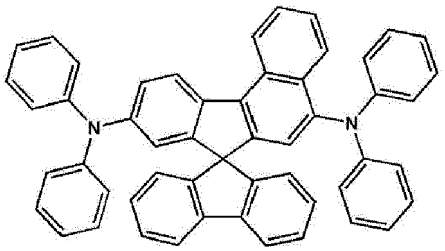
FD10



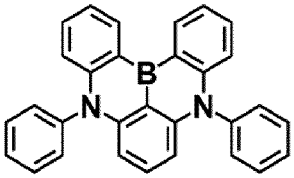
FD11



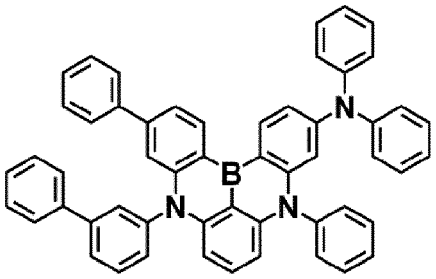
FD12



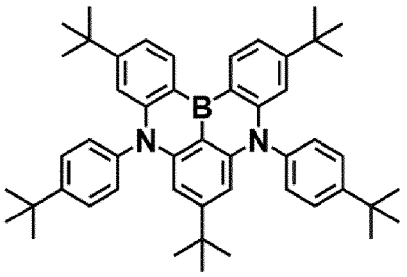
FD13



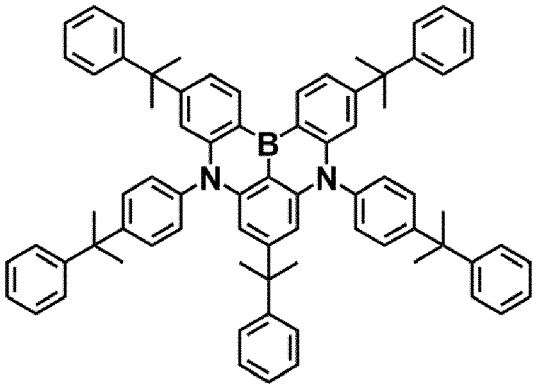
FD14



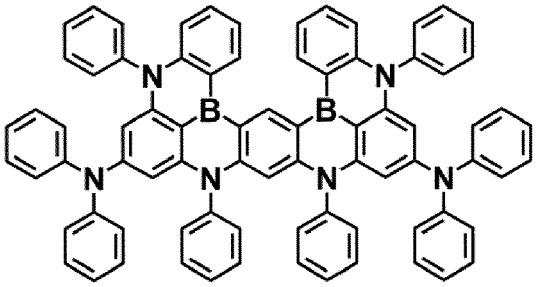
FD15



FD16



FD17



FD18

[0086] The amount of the cooling dopant in the emission layer may be from about 0.01 wt% to about 15 wt%, but embodiments of the present disclosure are not limited thereto.

[Sensitizer in emission layer 15]

[0087] The sensitizer may include Pt. In one embodiment, the sensitizer may be an organic metallic compound containing Pt.

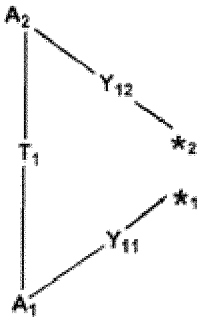
[0088] In one embodiment, the sensitizer may include Pt and an organic ligand (L_{11}), and L_{11} and Pt may form 1, 2, 3, or 4 cyclometalated rings.

[0089] In an embodiment, the sensitizer may include an organometallic compound represented by Formula 101:

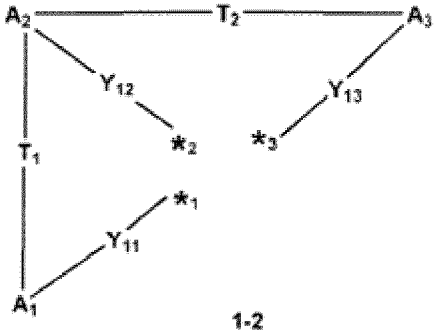
<Formula 101> $Pt(L_{11})_{n11}(L_{12})_{n12}$

wherein, in Formula 101,

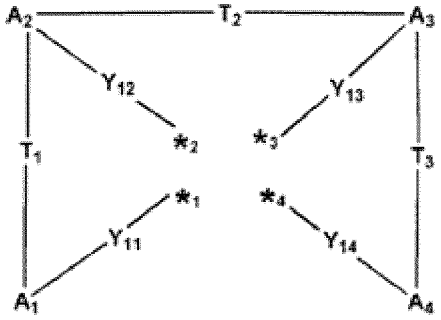
L_{11} is a ligand represented by one of Formulae 1-1 to 1-4;
L_{12} may be selected from a monodentate ligand and a bidentate ligand;
n11 may be 1,
n12 may be selected from 0, 1, and 2;



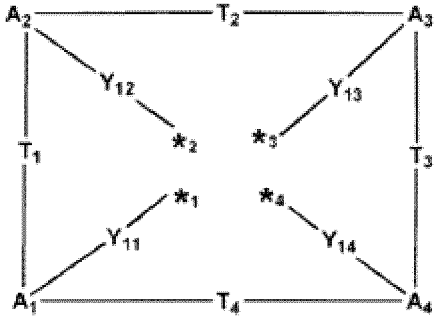
1-1



1-2



1-3



1-4

wherein, in Formulae 1-1 to 1-4,

A_1 to A_4 may each independently be selected from a substituted or unsubstituted C_5-C_{30} carbocyclic group, a substituted or unsubstituted C_1-C_{30} heterocyclic group, and a non-cyclic group,

Y_{11} to Y_{14} may each independently be a chemical bond, O, S, $N(R_{91})$, $B(R_{91})$, $P(R_{91})$, or $C(R_{91})(R_{92})$,

T_1 to T_4 may each independently be selected from a single bond, a double bond, *-$N(R_{93})$-*', *-$B(R_{93})$-*', *-$P(R_{93})$-*', *-$C(R_{93})(R_{94})$-*', *-$Si(R_{93})(R_{94})$-*', *-$Ge(R_{93})(R_{94})$-*', *-S-*', *-Se-*', *-0-*', *-C(=O)-*', *-S(=O)-*', *-$S(=O)_2$-*', *-$C(R_{93})$=*', *=$C(R_{93})$-*', *-$C(R_{93})$=$C(R_{94})$-*', *-C(=S)-*', and *-C≡C-*',

a substituent of the substituted C_5-C_{30} carbocyclic group, a substituent of substituted C_1-C_{30} heterocyclic group, and R_{91} to R_{94} may each independently be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, $-SF_5$, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a substituted or unsubstituted C_1-C_{60} alkyl group, a substituted or unsubstituted C_2-C_{60} alkenyl group, a substituted or unsubstituted C_2-C_{60} alkynyl group, a substituted or unsubstituted C_1-C_{60} alkoxy group, a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10}heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group, $-Si(Q_1)(Q_2)(Q_3)$, $-B(Q_1)(Q_2)$, $-N(Q_1)(Q_2)$, $-P(Q_1)(Q_2)$, $-C(=O)(Q_1)$, $-S(=O)(Q_1)$, $-S(=O)_2(Q_1)$, $-P(=O)(Q_1)(Q_2)$, and $-P(=S)(Q_1)(Q_2)$, wherein each of a substituent of the substituted C_5-C_{30} carbocyclic group and a substituent of substituted C_1-C_{30} heterocyclic group is not hydrogen,

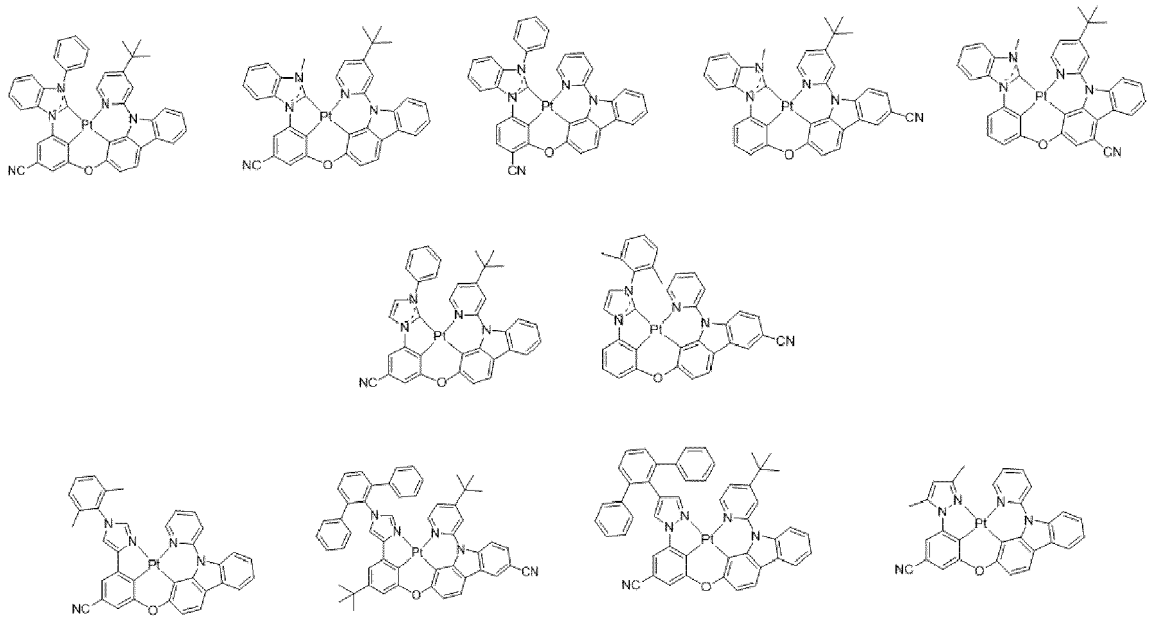
$*_1$, $*_2$, $*_3$, and $*_4$ each indicate a binding site to Pt, and

Q_1 to Q_3 may each independently selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10} heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_7-C_{60} alkyl aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a C_2-C_{60} alkyl heteroaryl group, a C_1-C_{60} heteroaryloxy group, a C_1-C_{60} heteroarylthio group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group, a C_1-C_{60} alkyl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group, and a C_6-C_{60} aryl group that is substituted with at least one selected from deuterium,

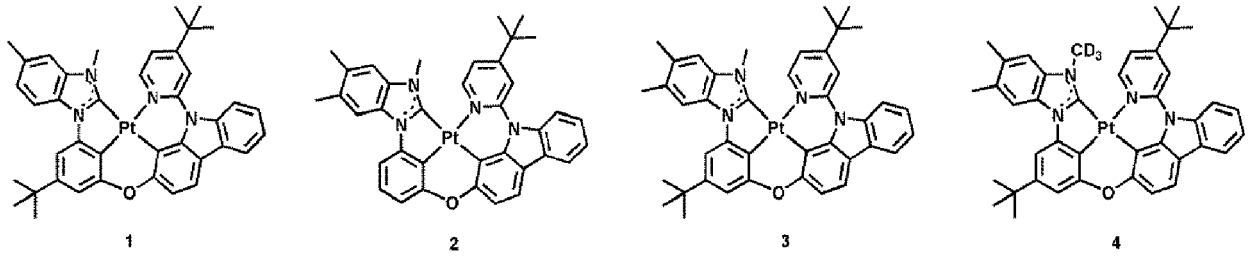
-F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group.

[0090] In one or more embodiments, the sensitizer may be selected from Groups I, II, III, V and VI, but embodiments of the present disclosure are not limited thereto:

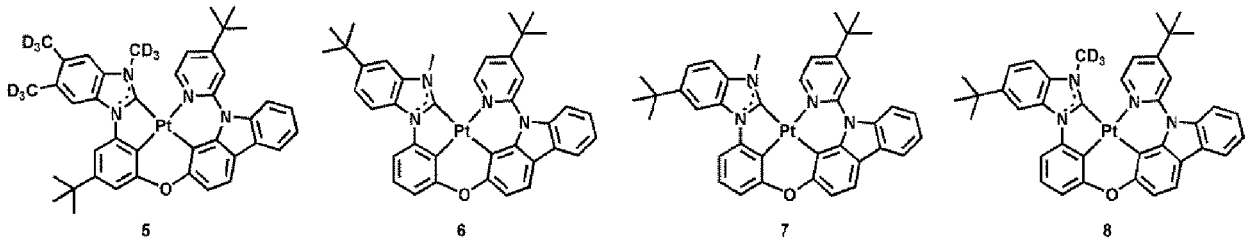
<Group I>



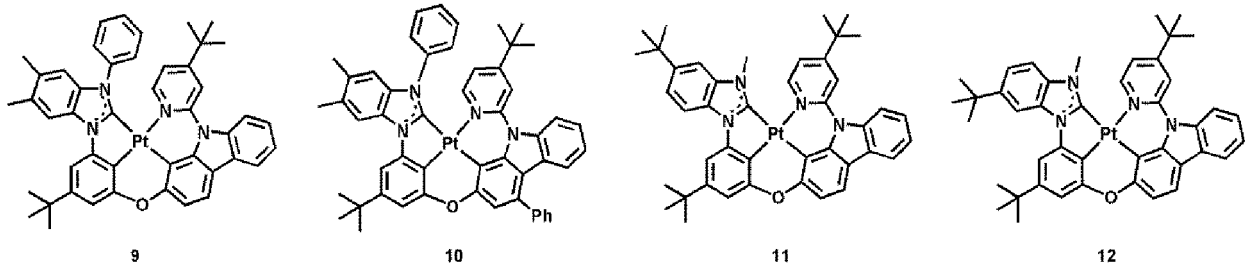
<Group II>



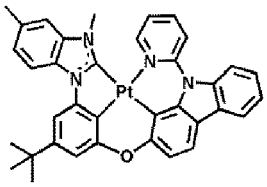
1 2 3 4



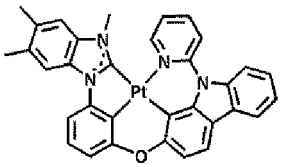
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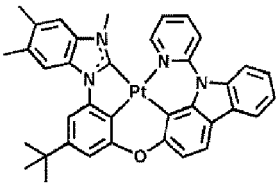
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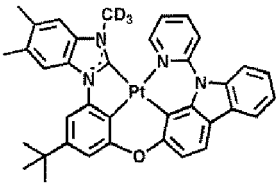
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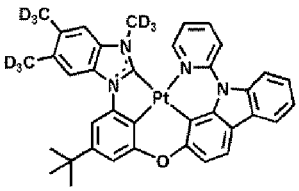
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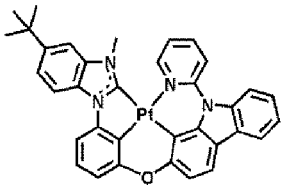
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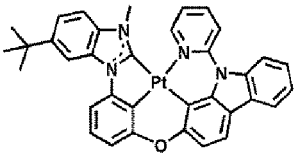
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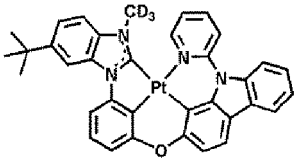
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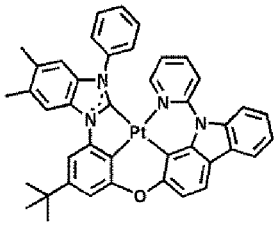
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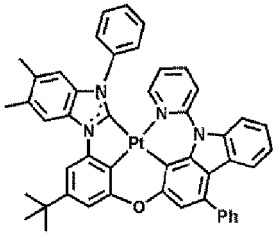
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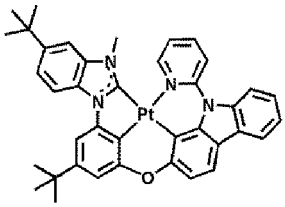
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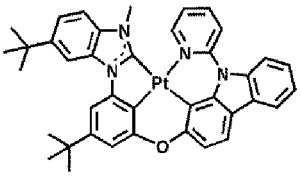
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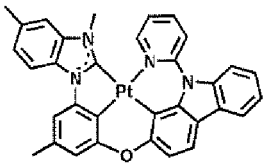
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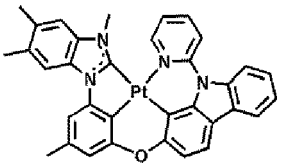
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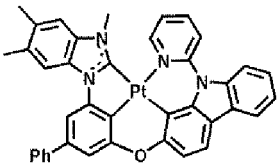
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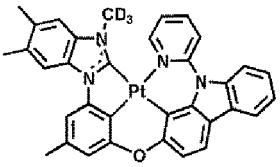
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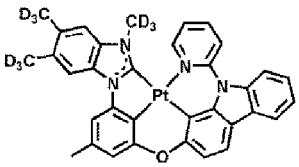
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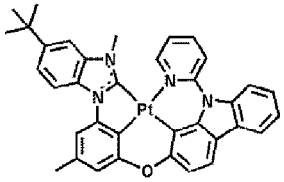
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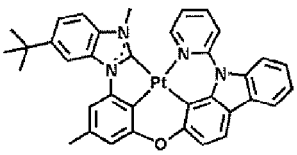
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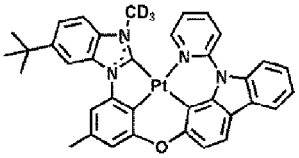
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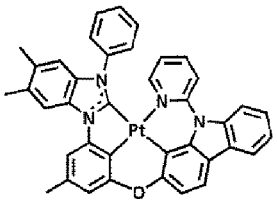
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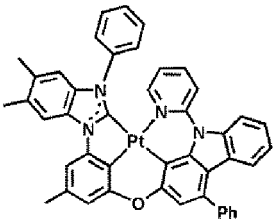
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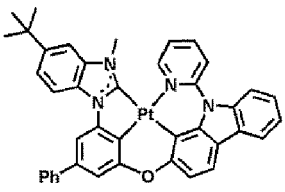
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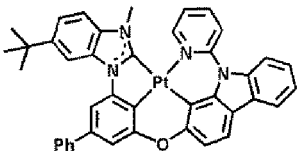
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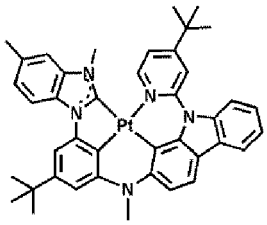
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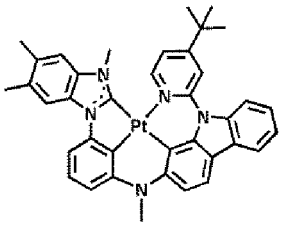
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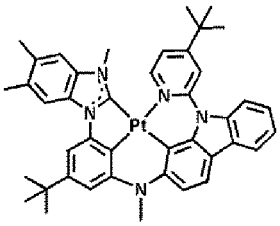
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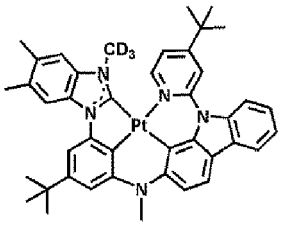
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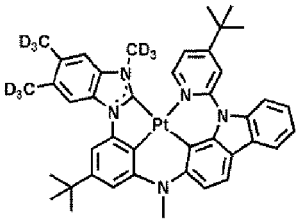
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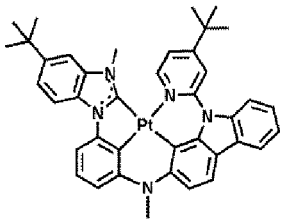
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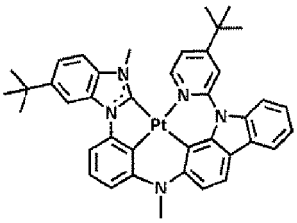
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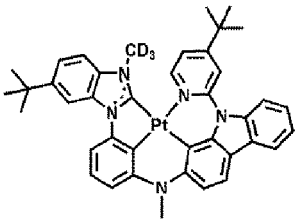
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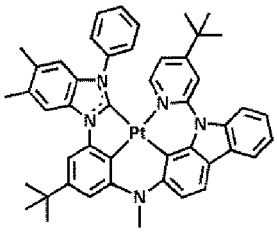
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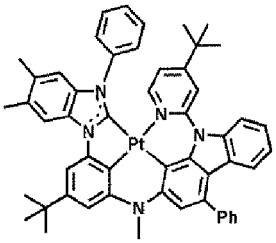
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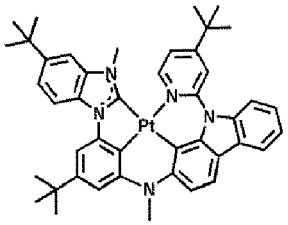
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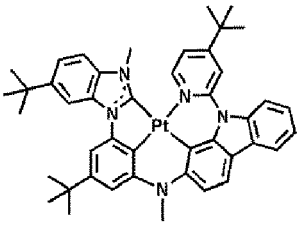
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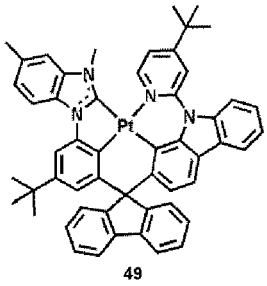
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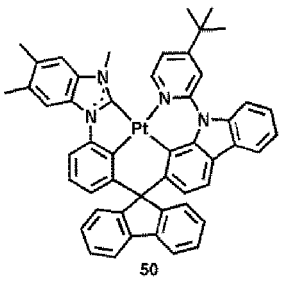
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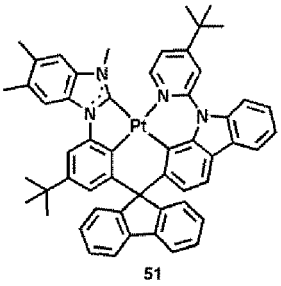
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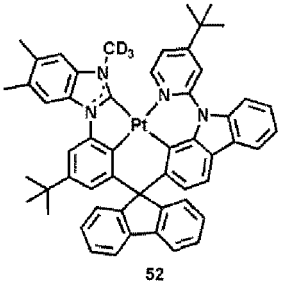
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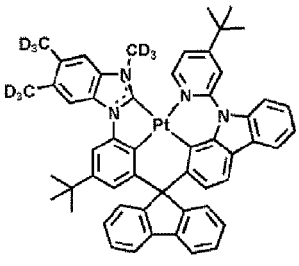
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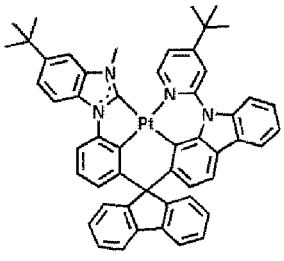
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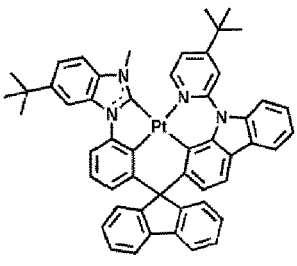
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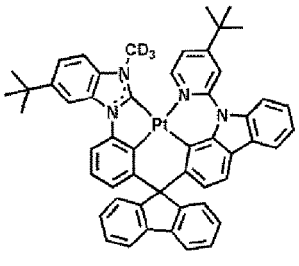
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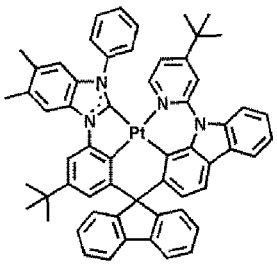
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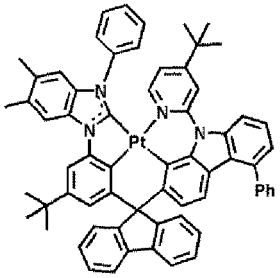


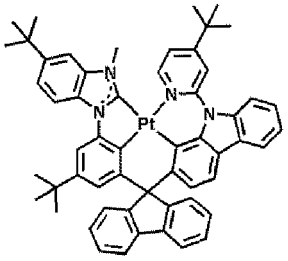
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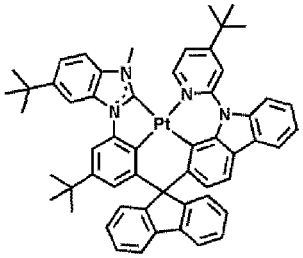


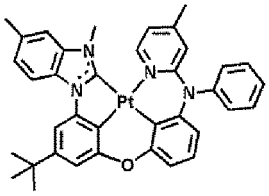
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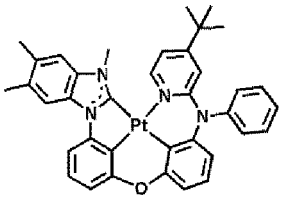

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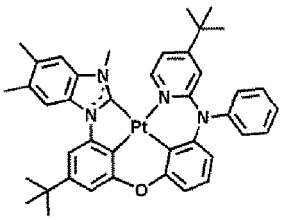

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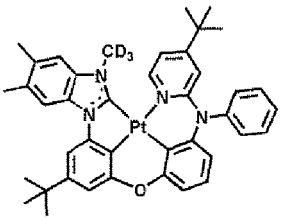

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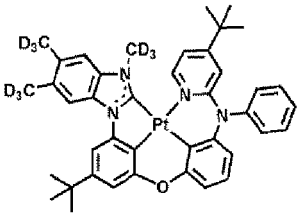

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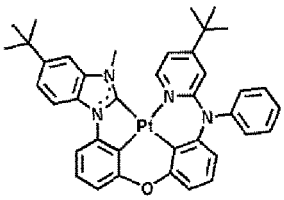

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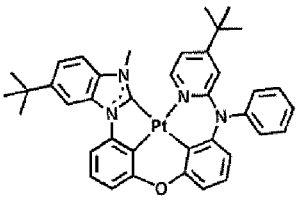

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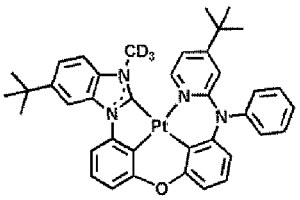

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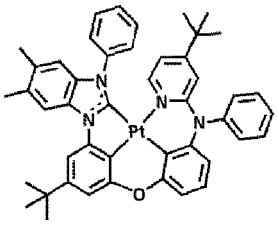

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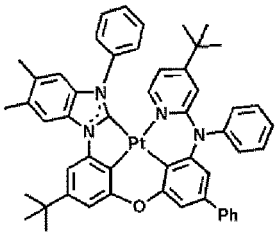

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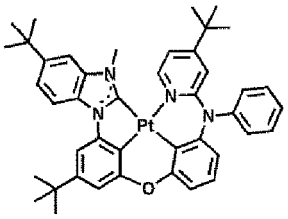

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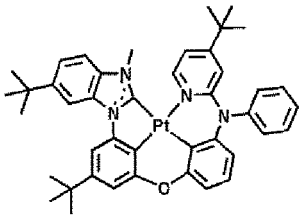

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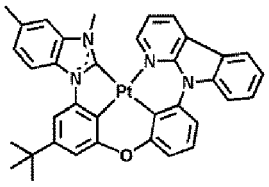

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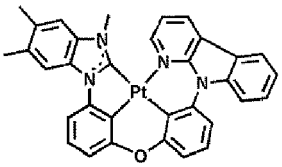

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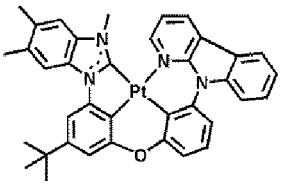

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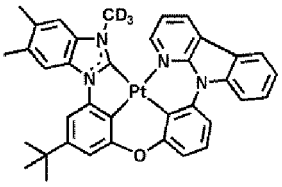

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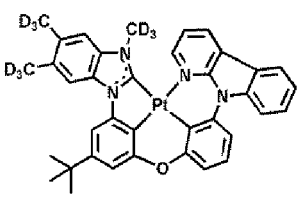

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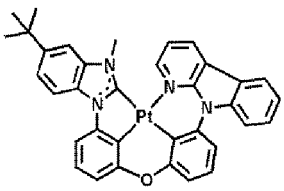

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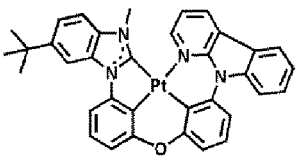

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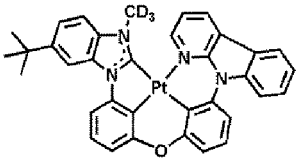

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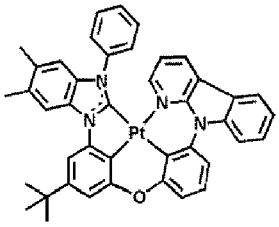

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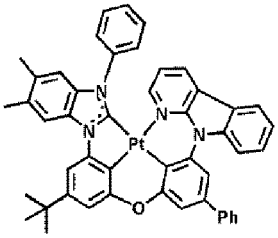

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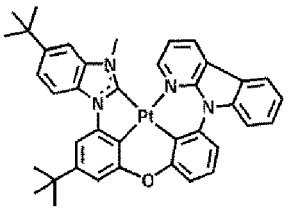

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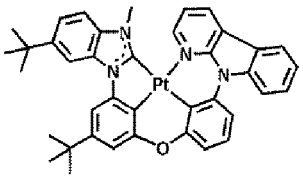
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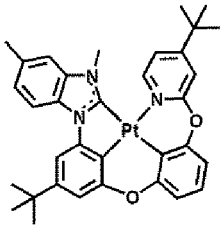
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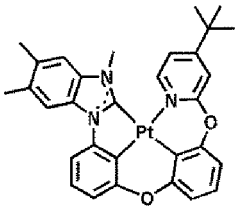
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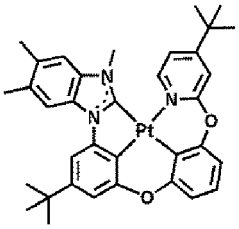
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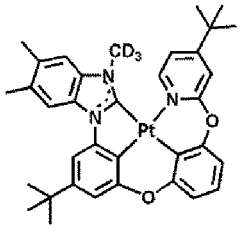
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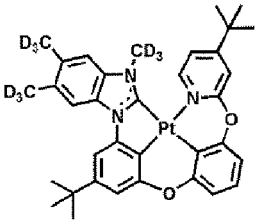
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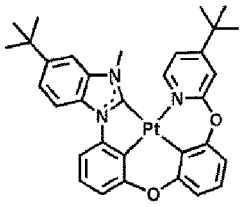
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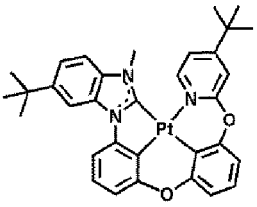
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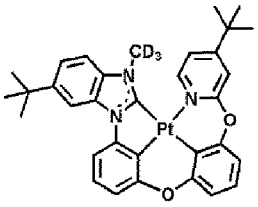
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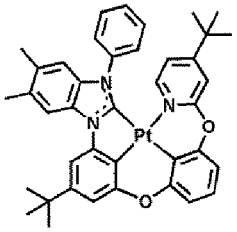
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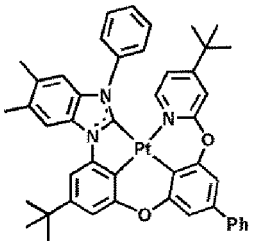
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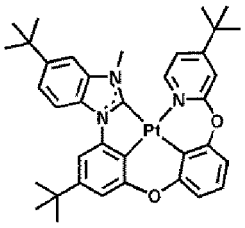
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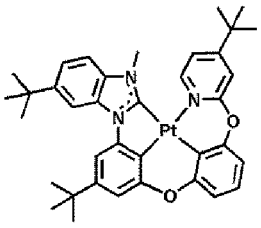
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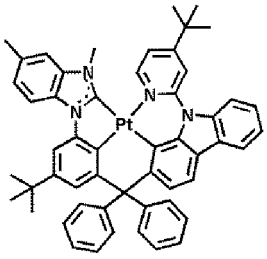
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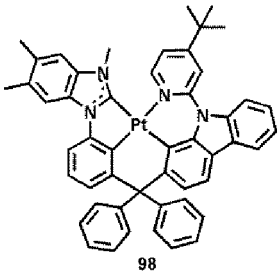
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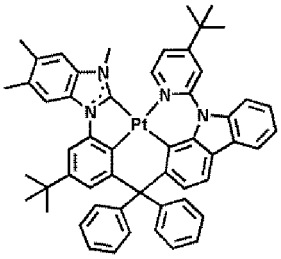
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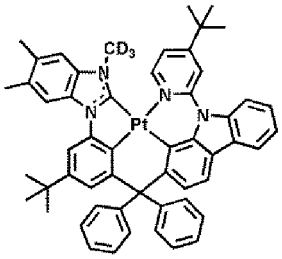
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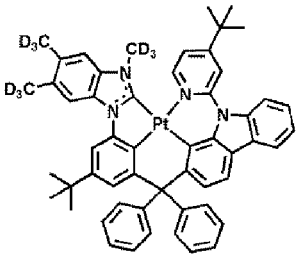
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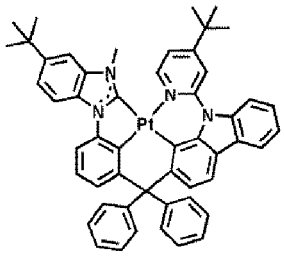
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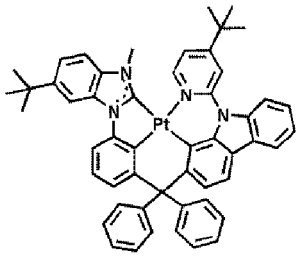
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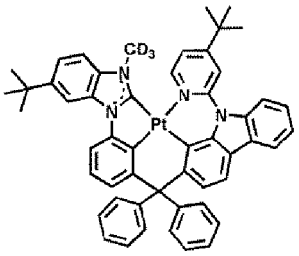
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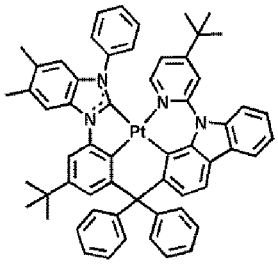
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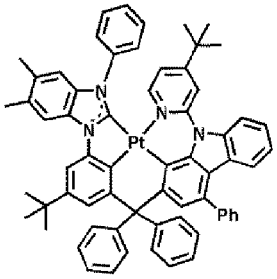
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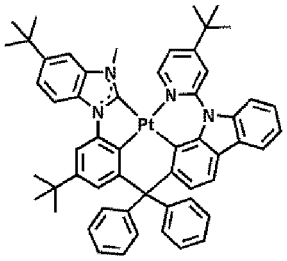
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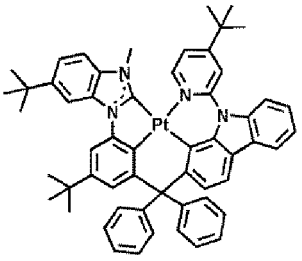
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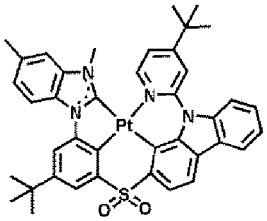
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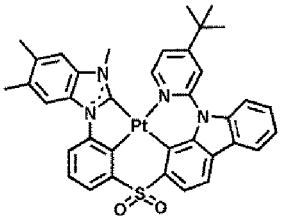
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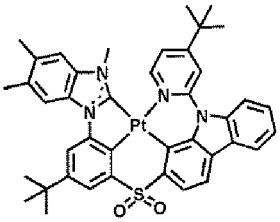
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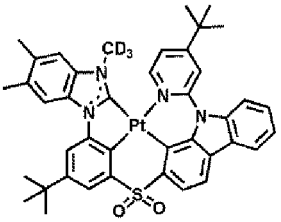
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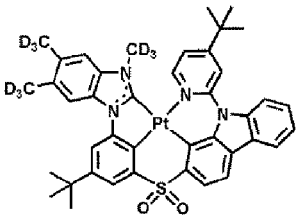
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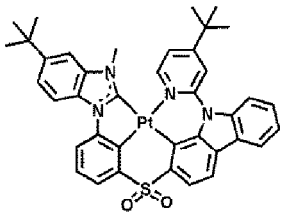
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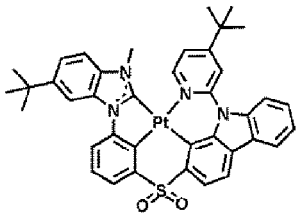
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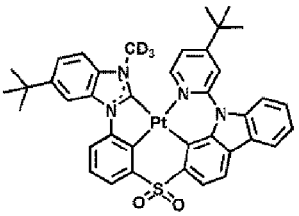
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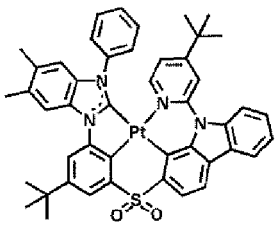
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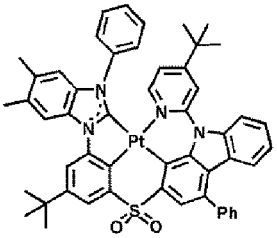
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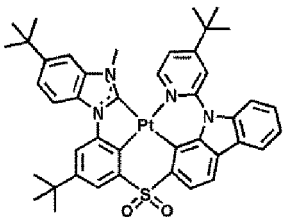
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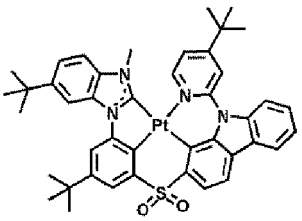
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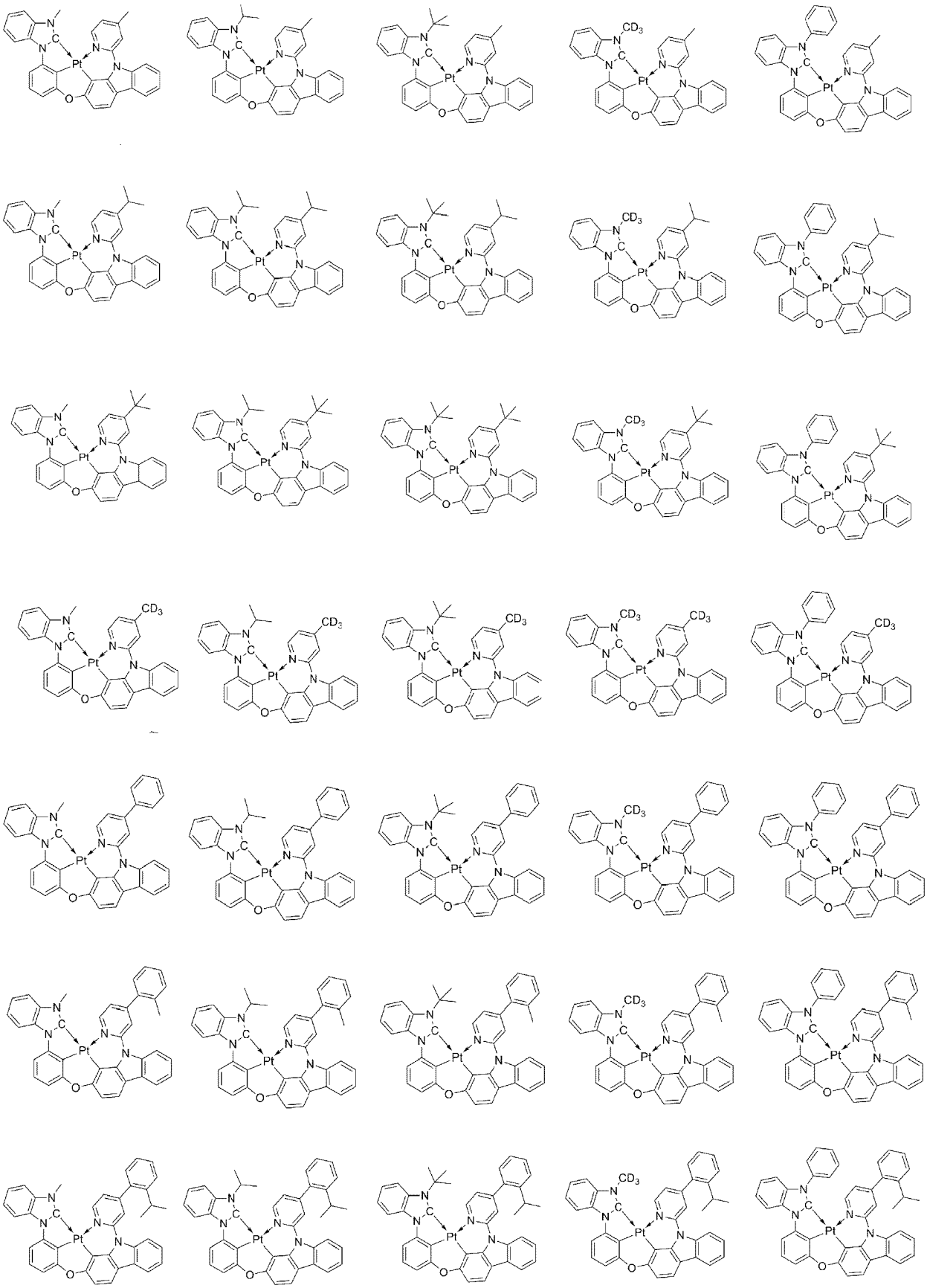


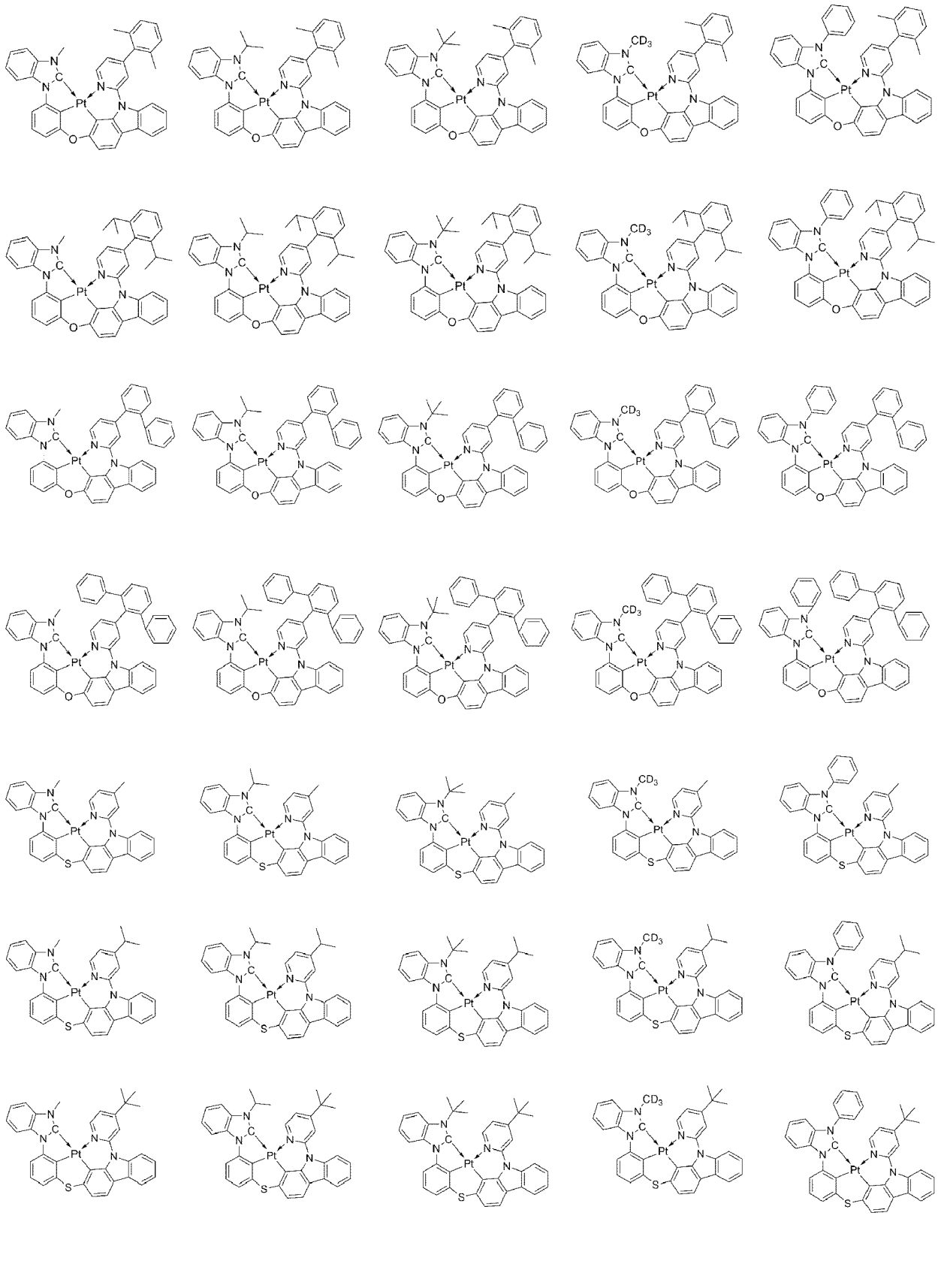
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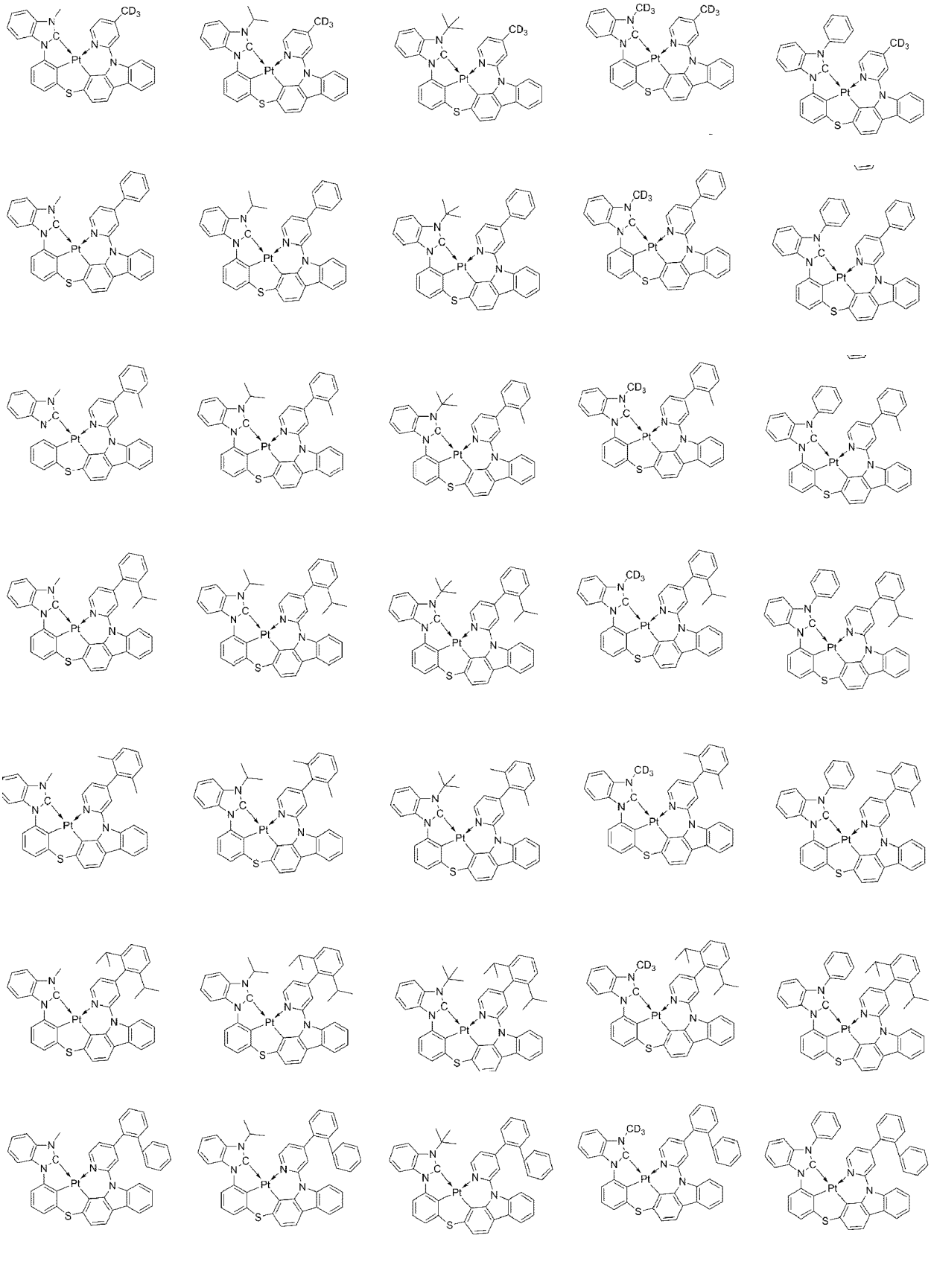


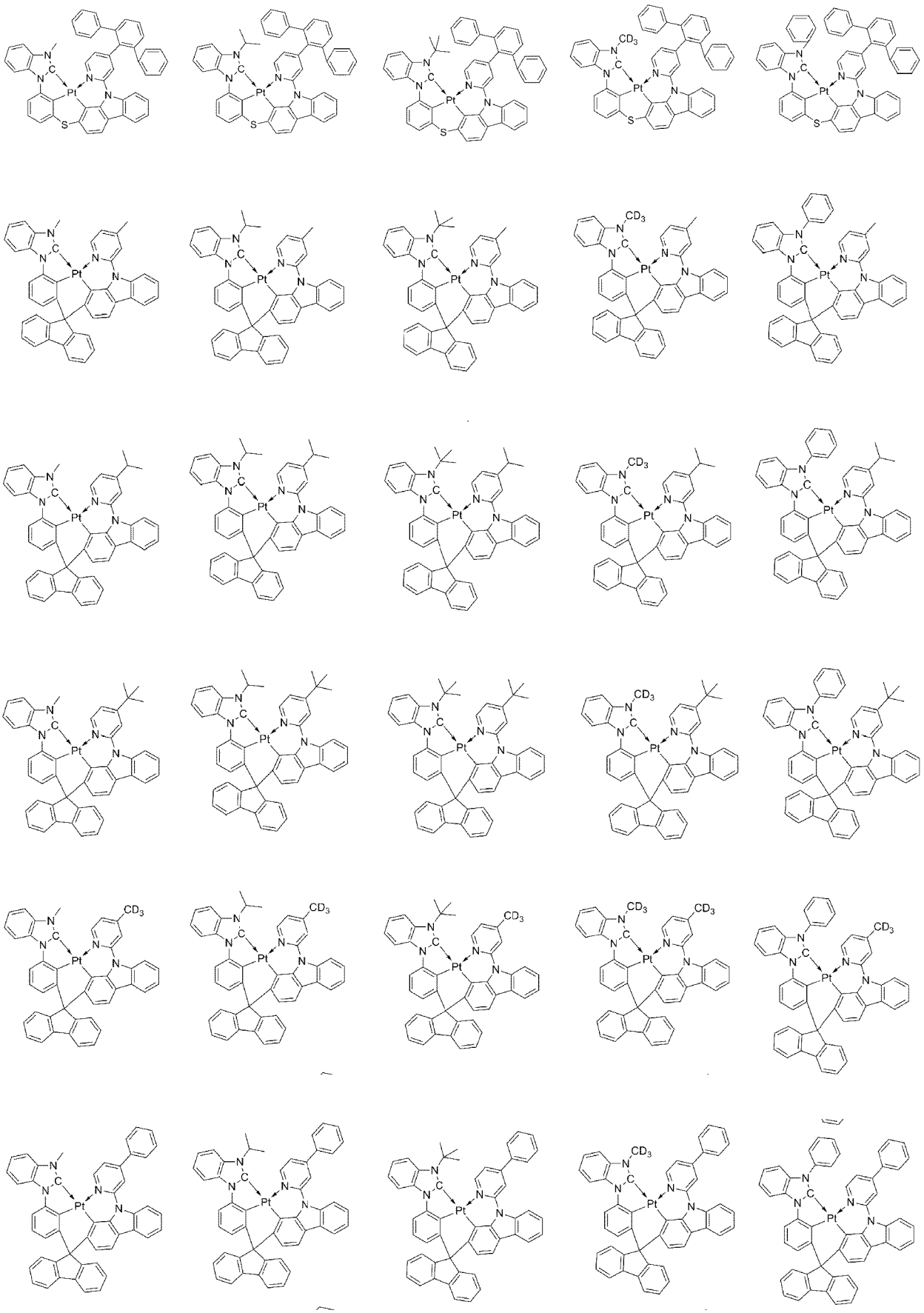
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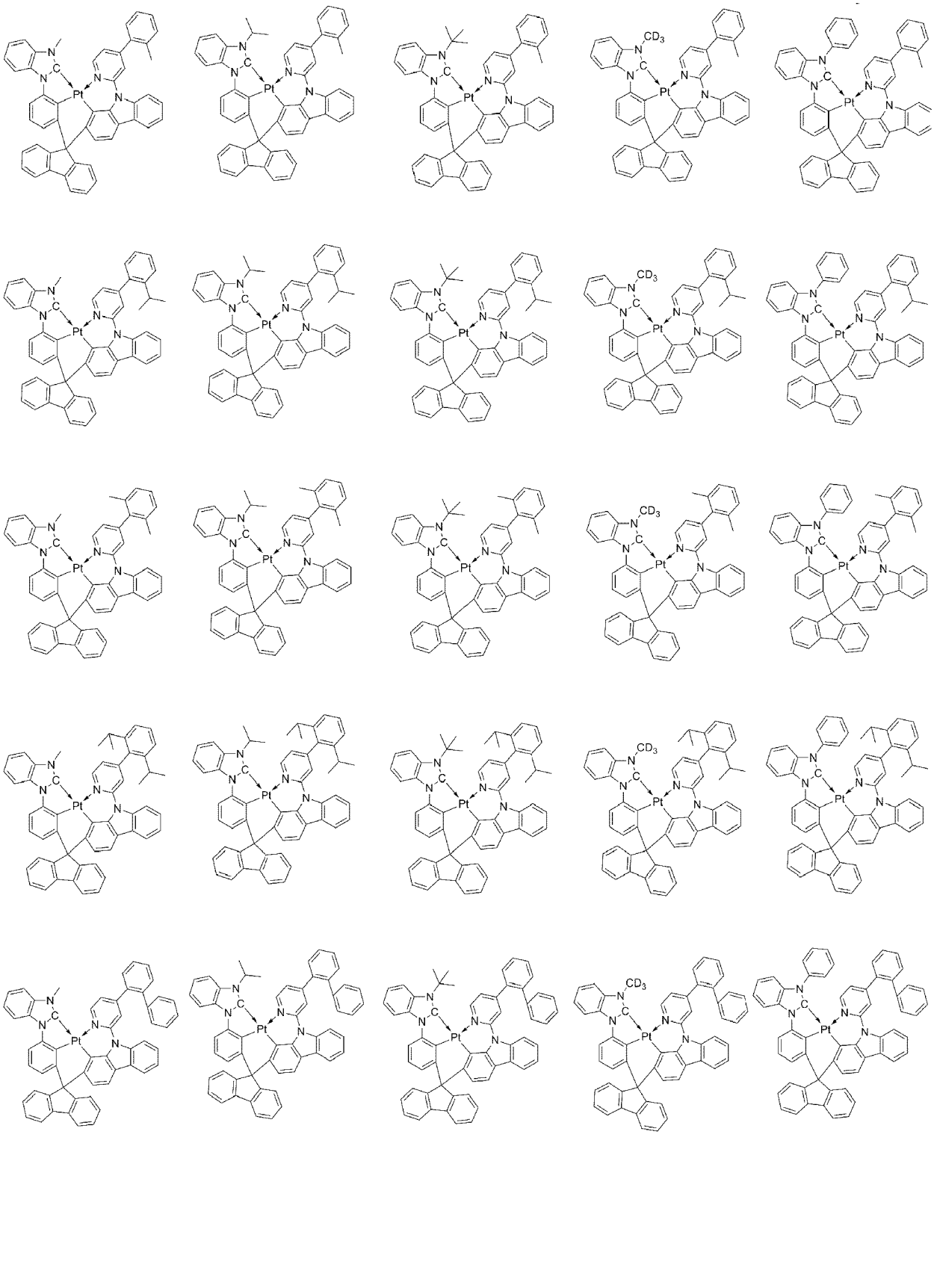
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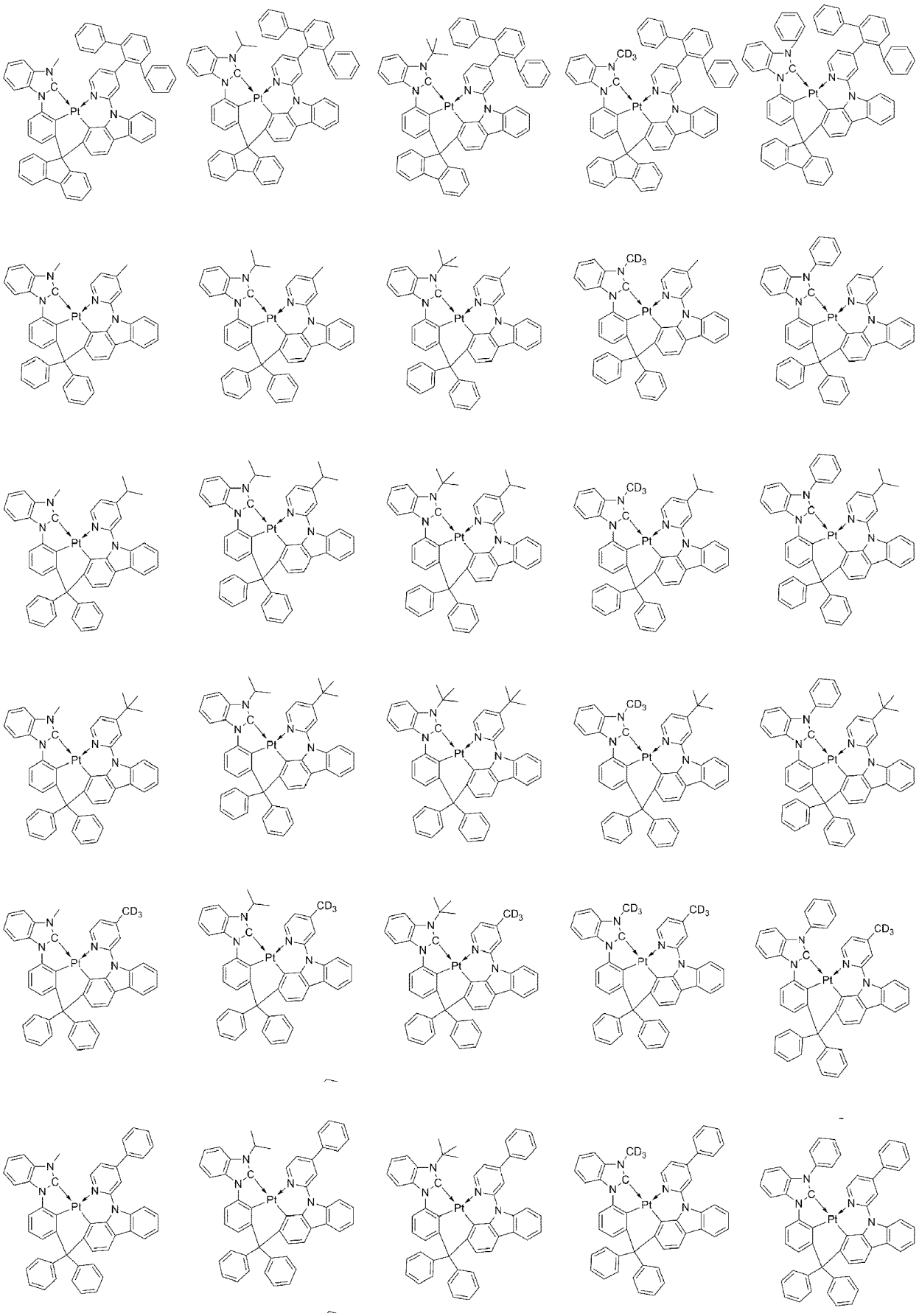


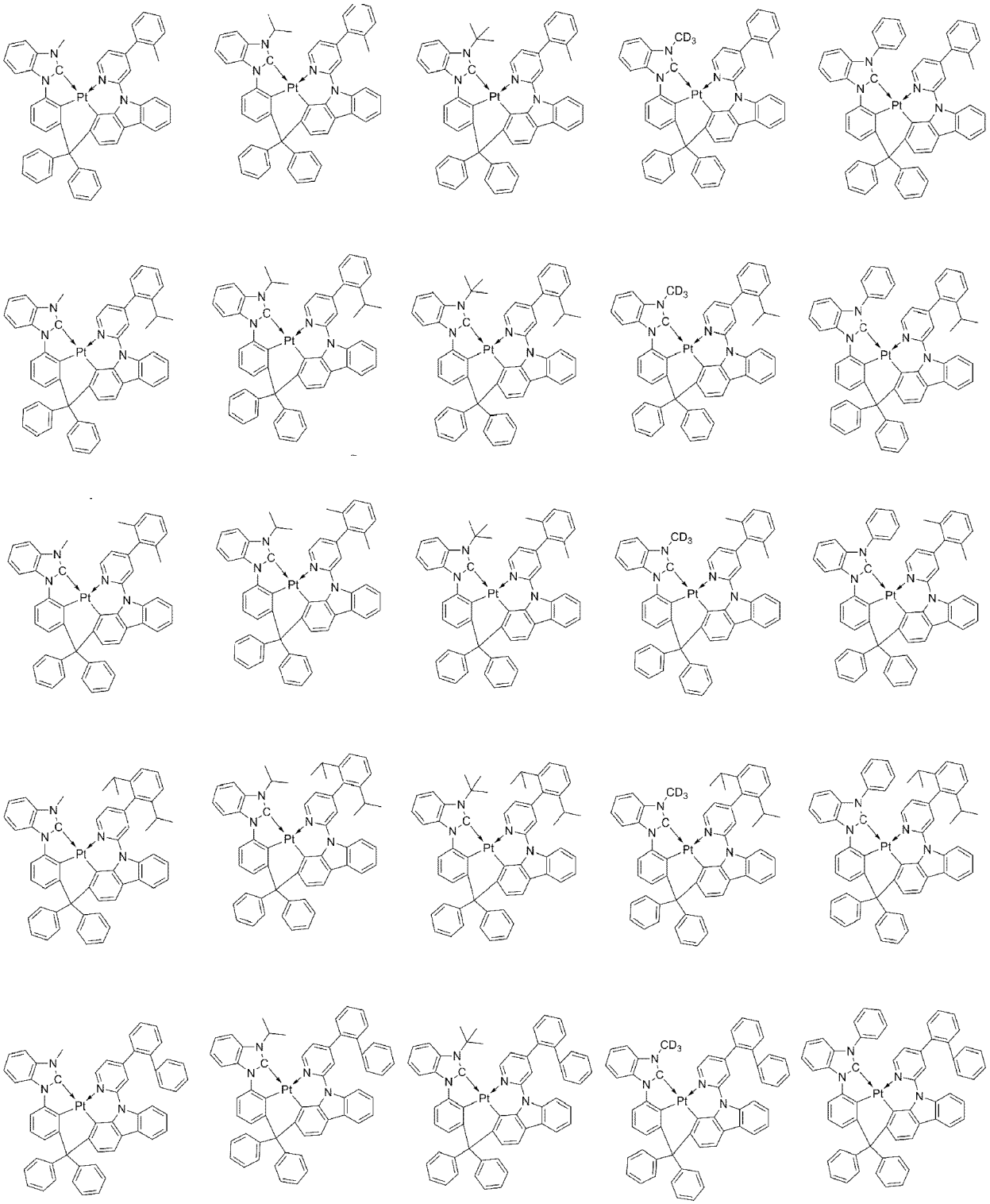


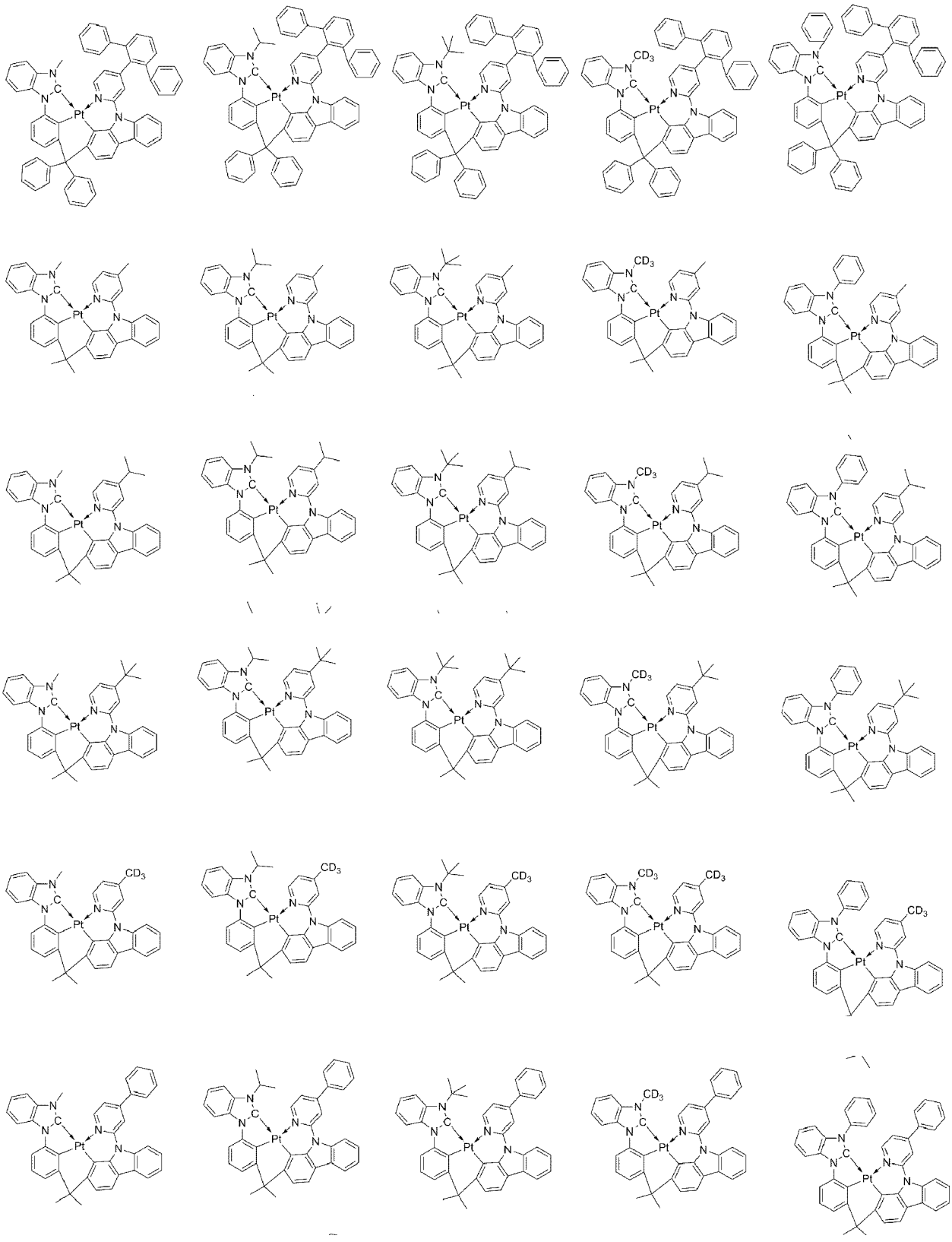


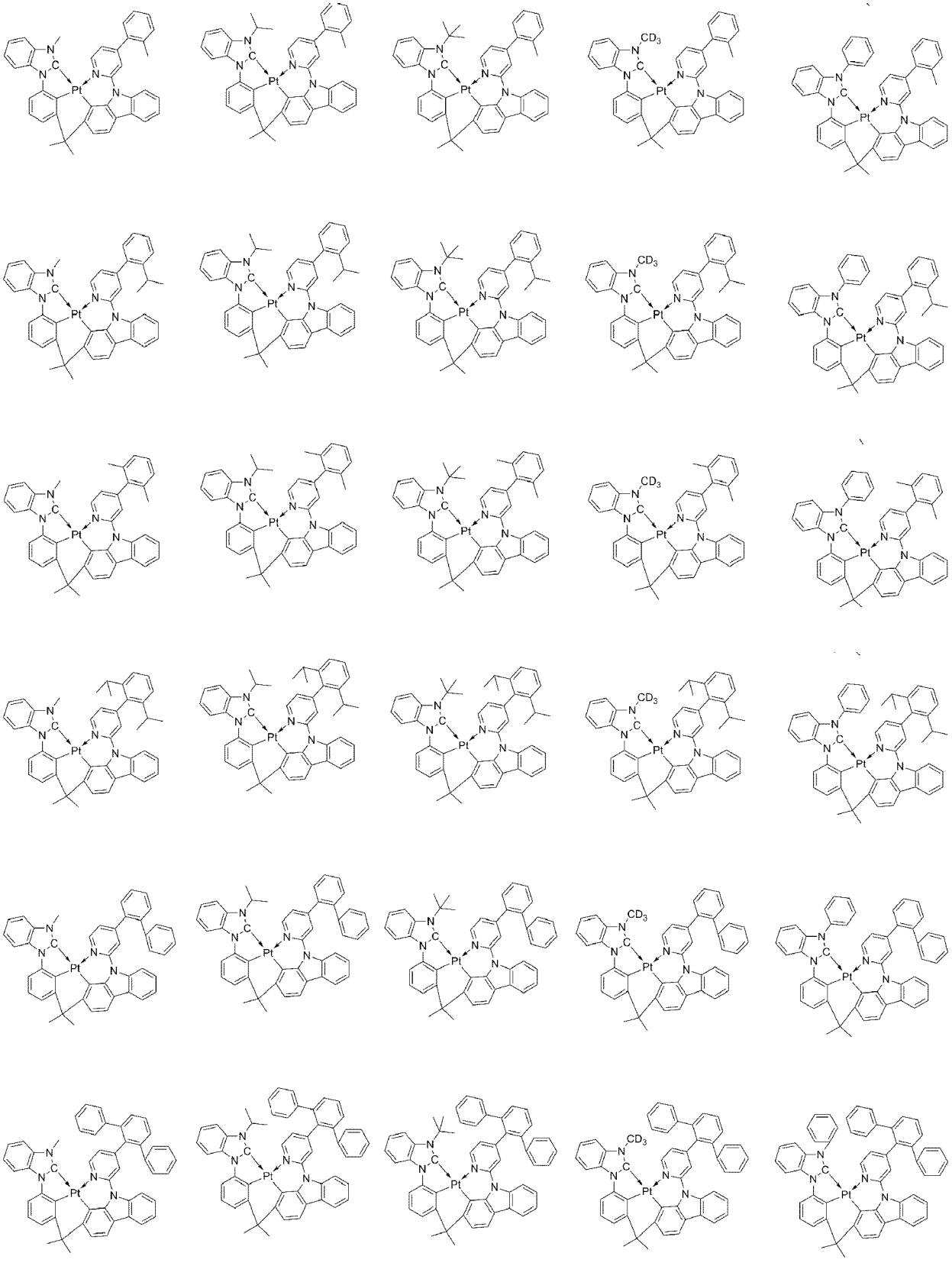


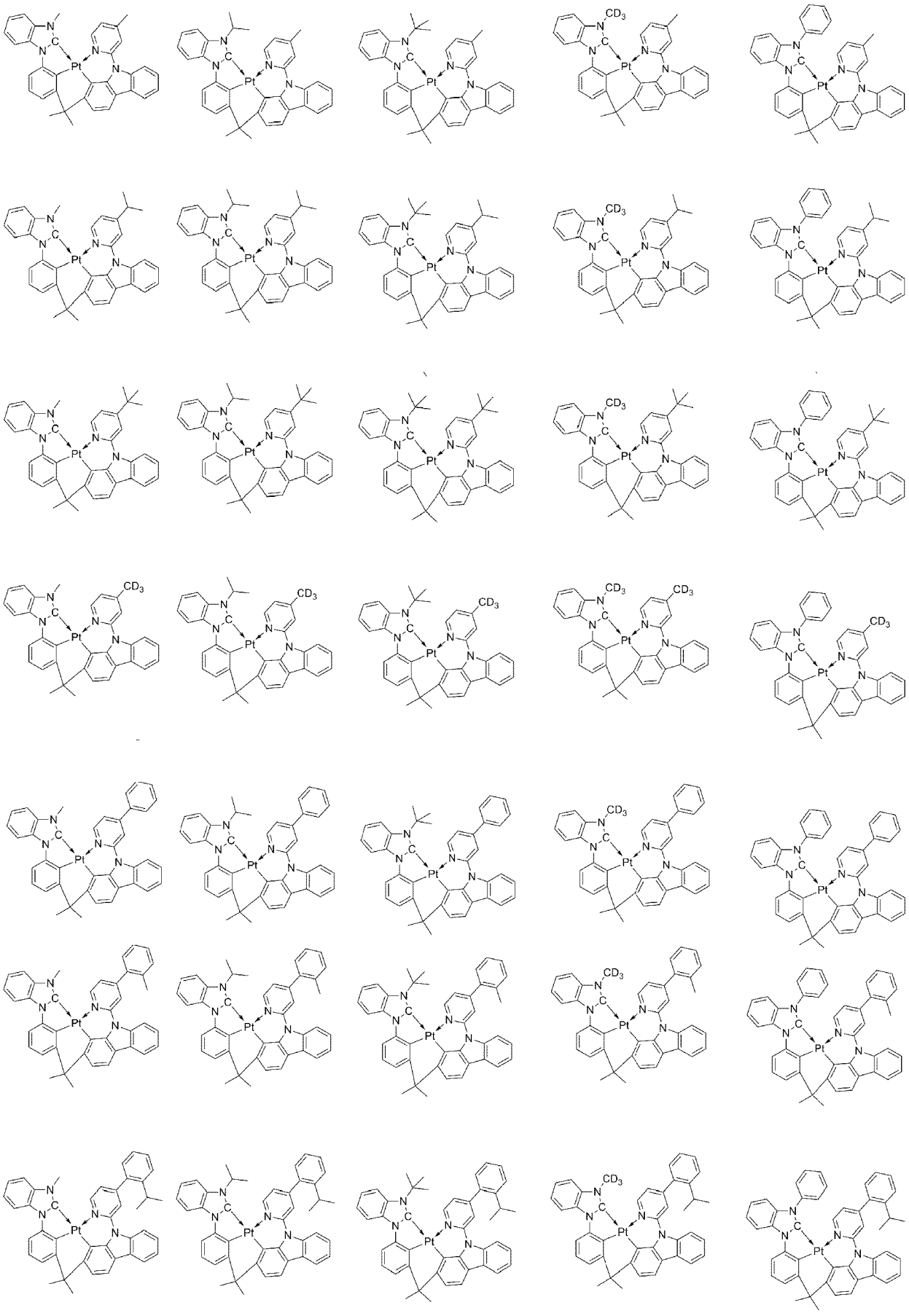


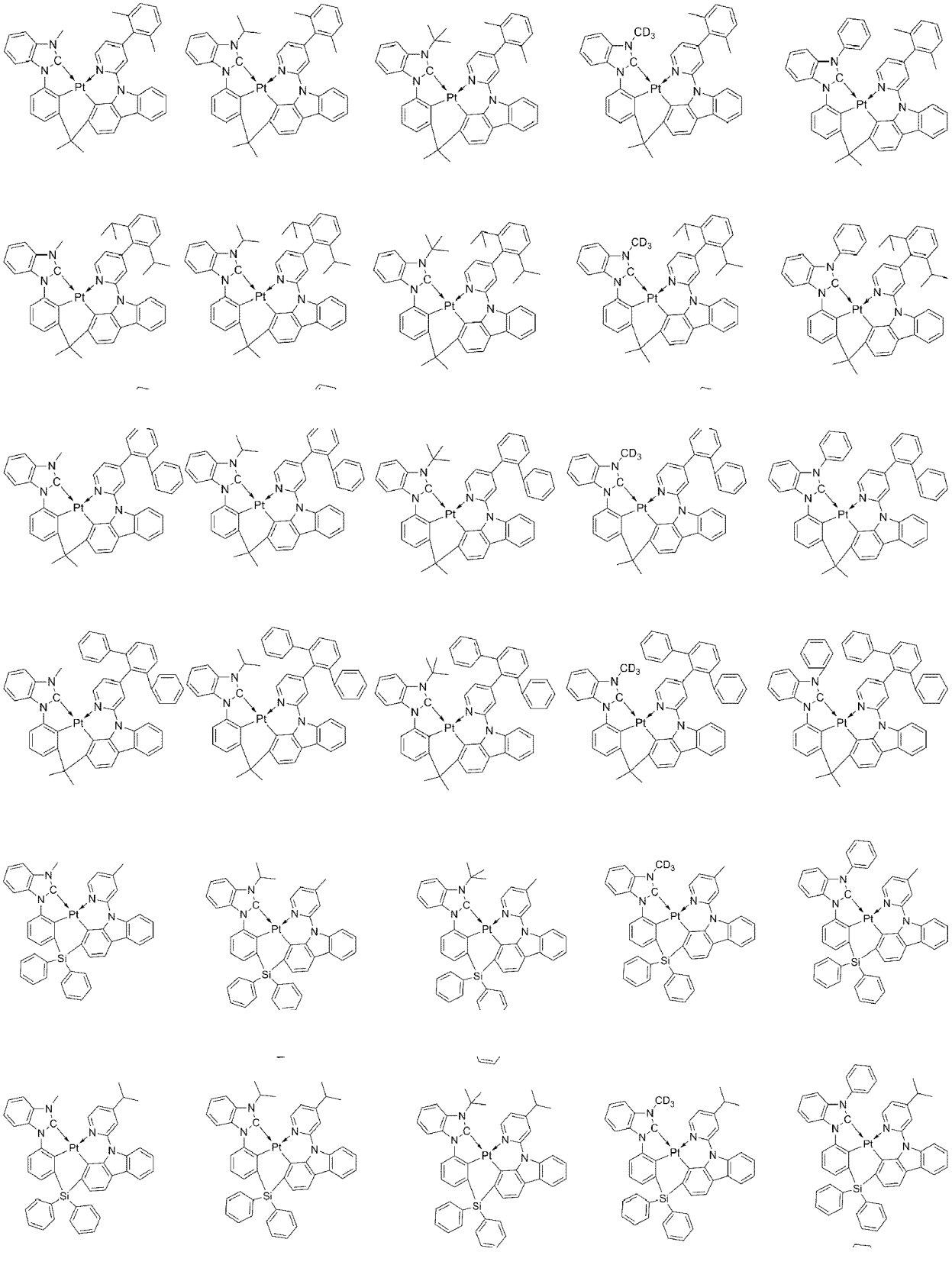


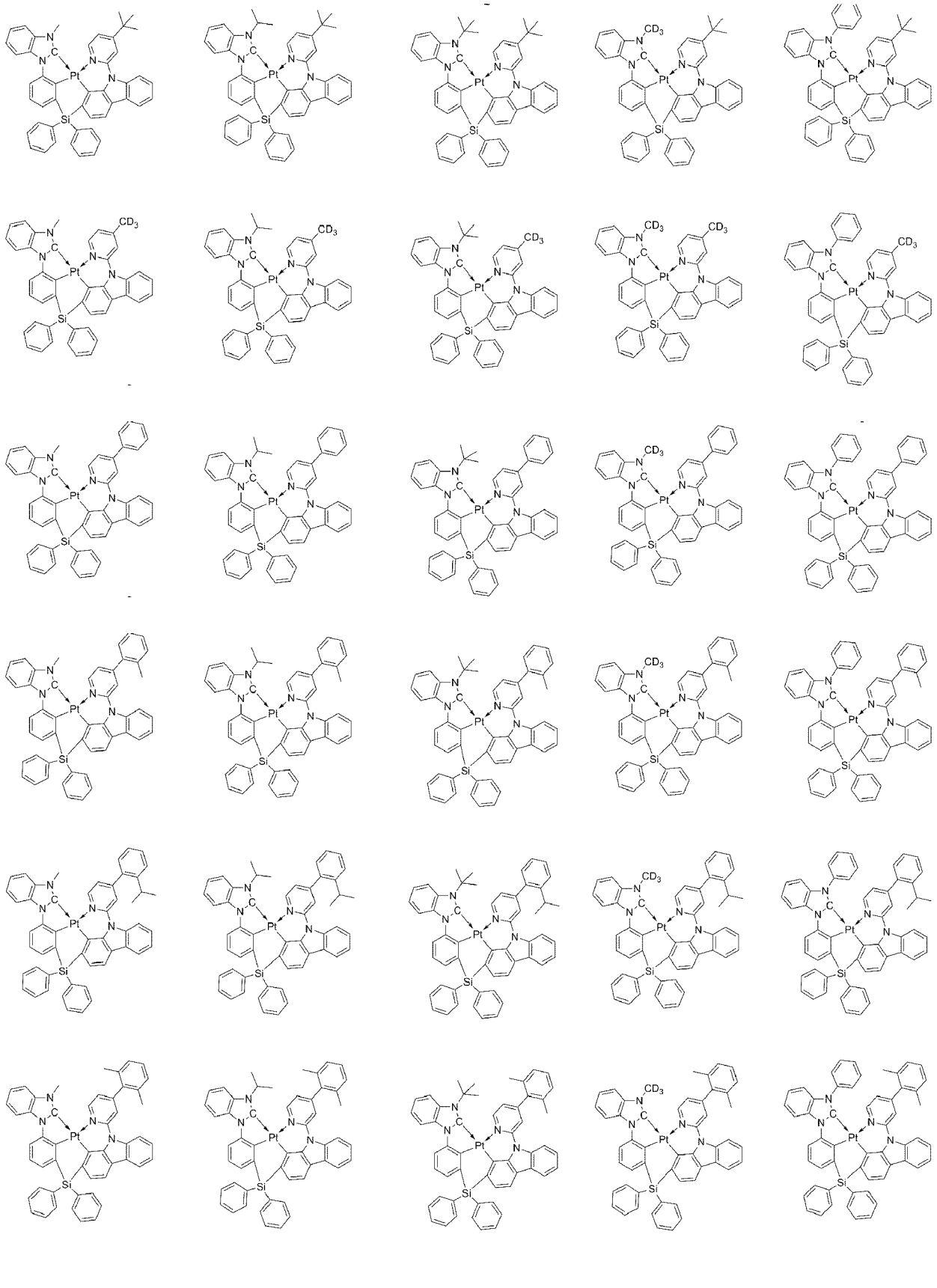


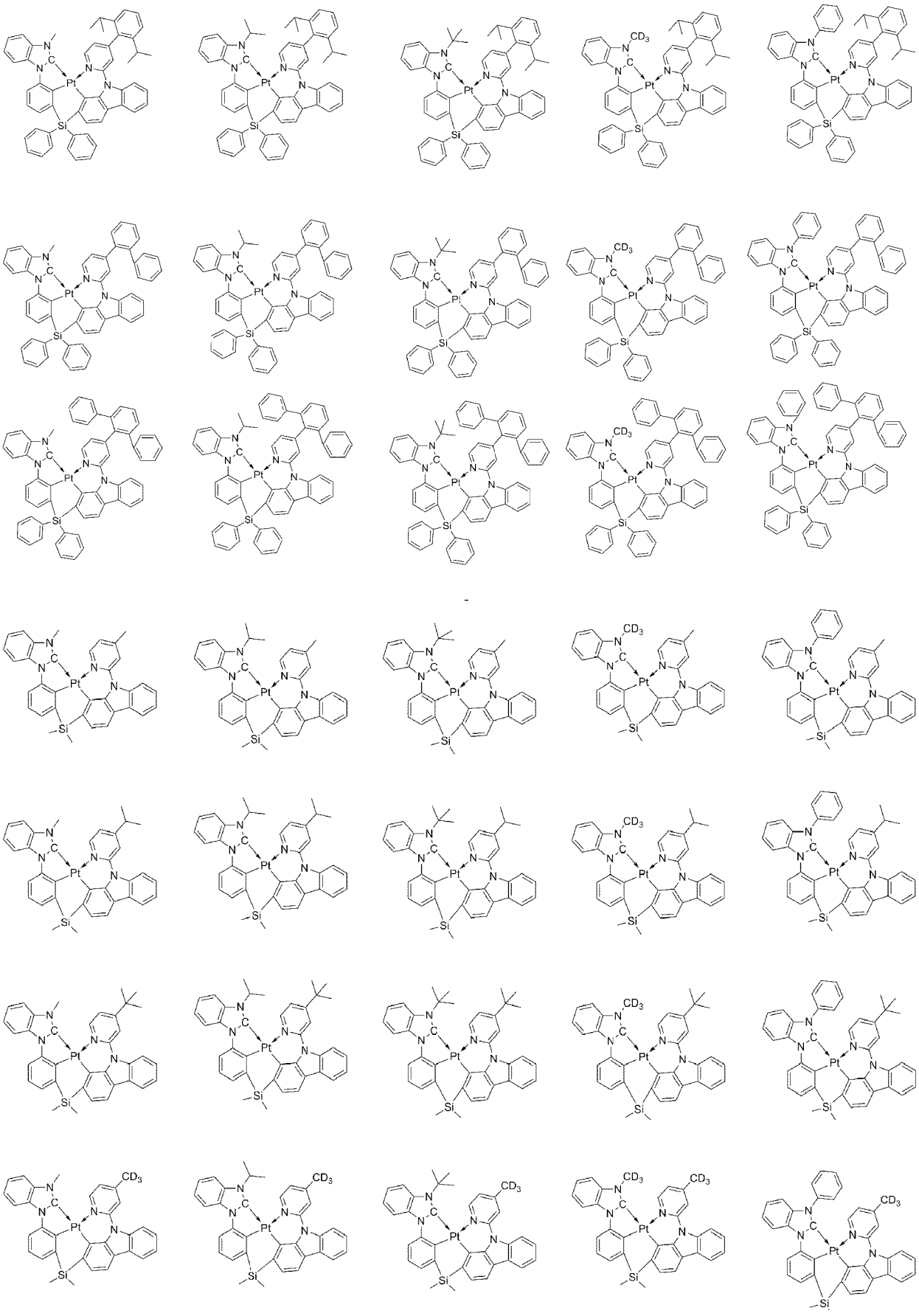


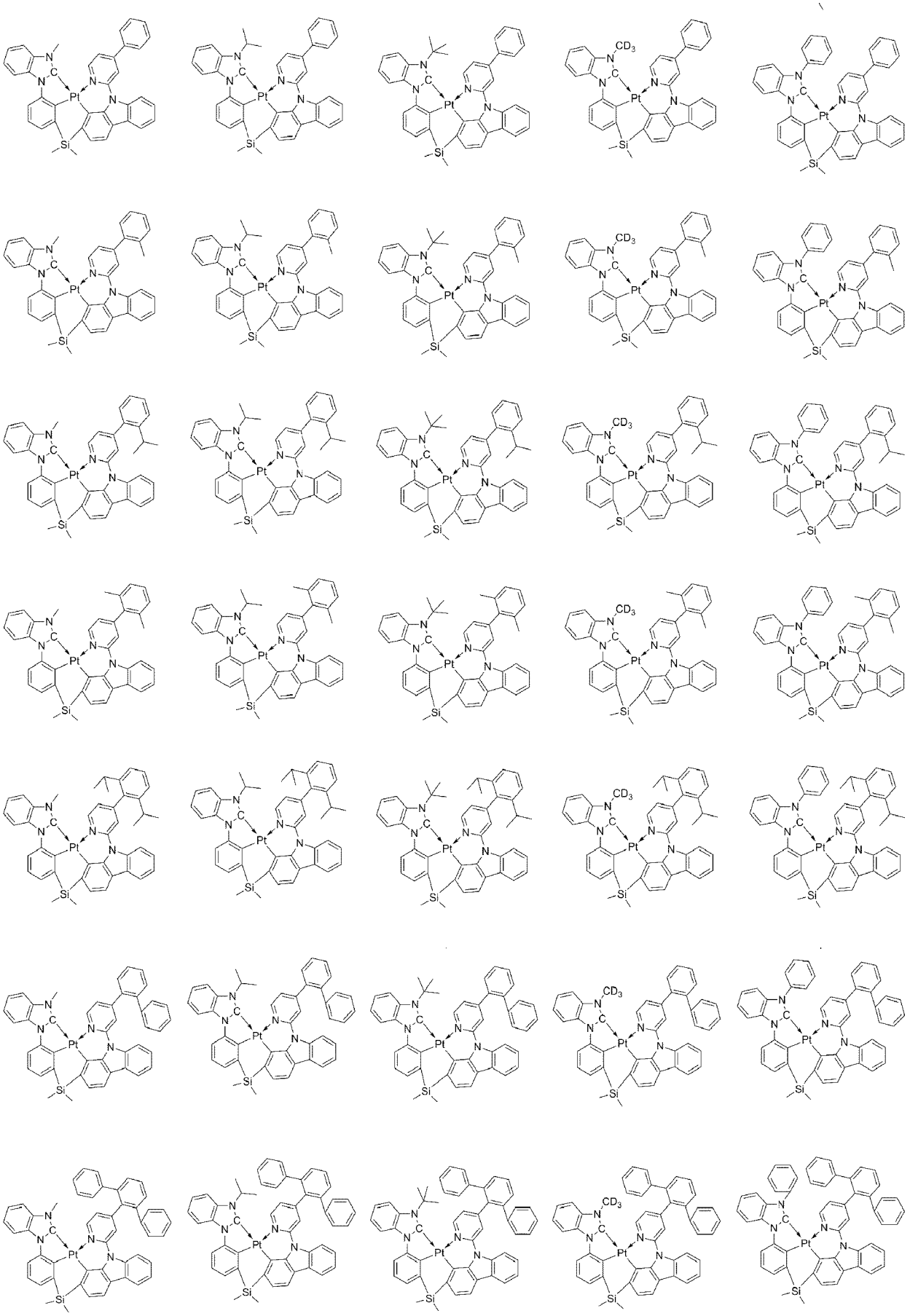


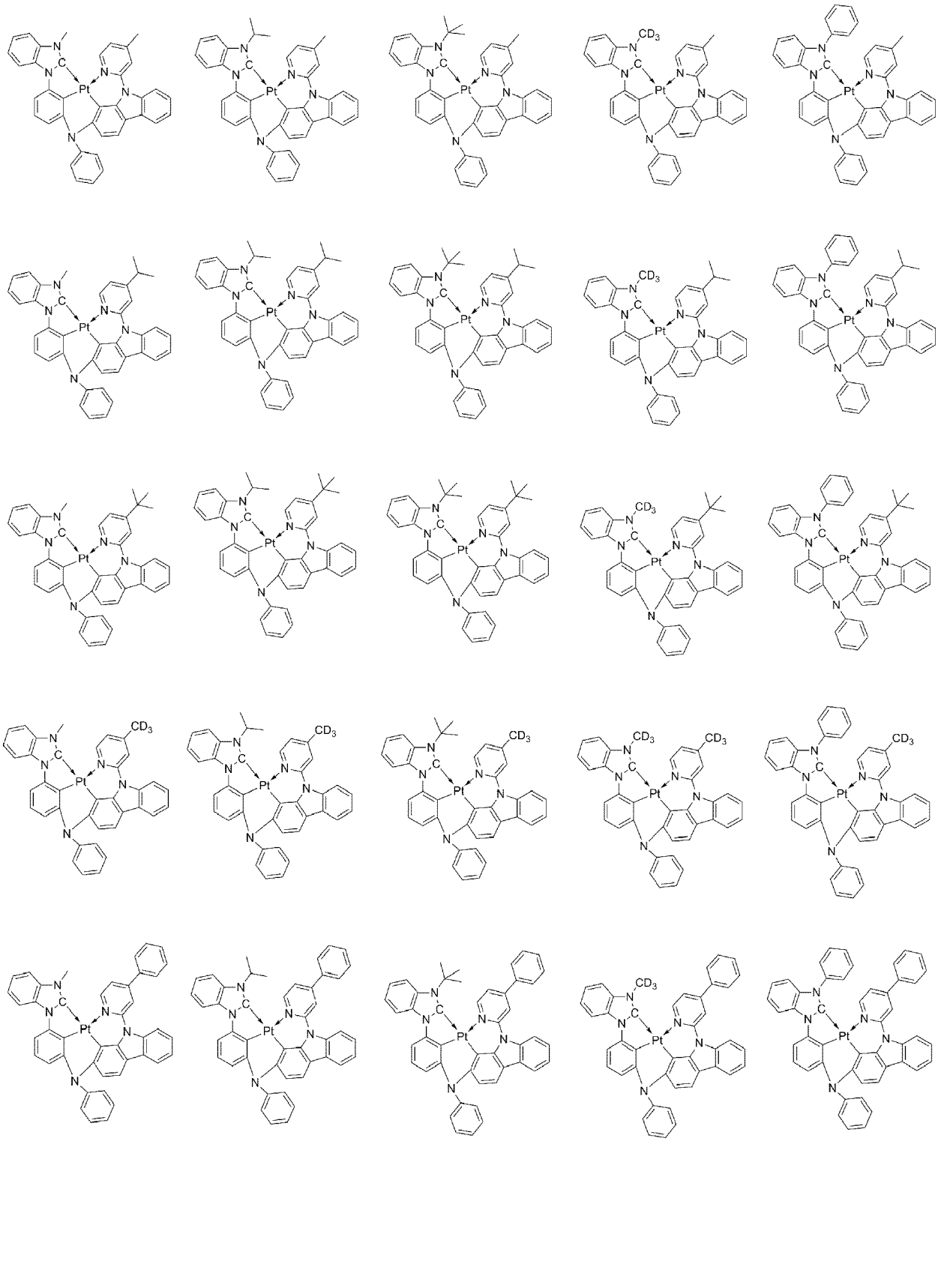


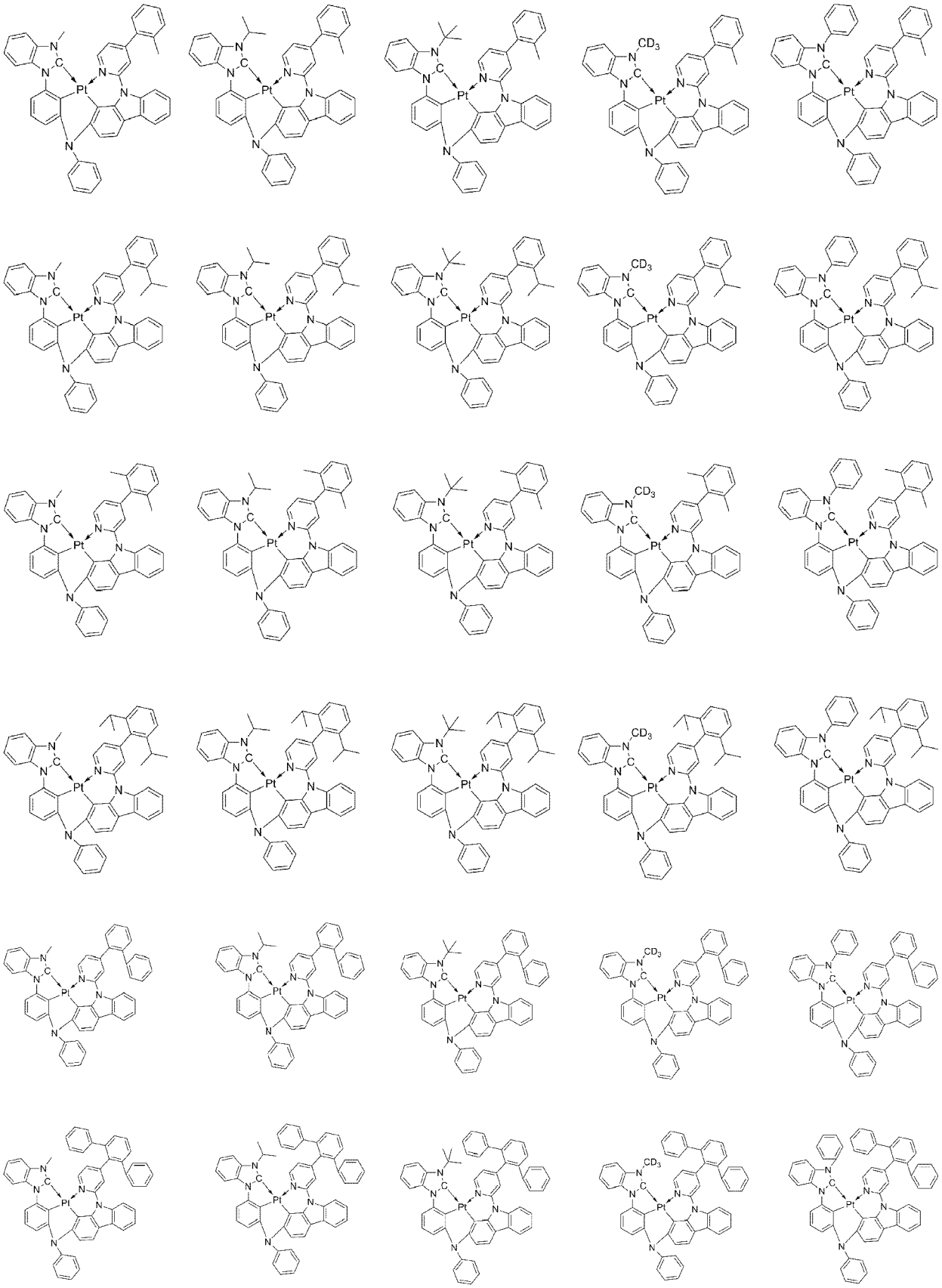


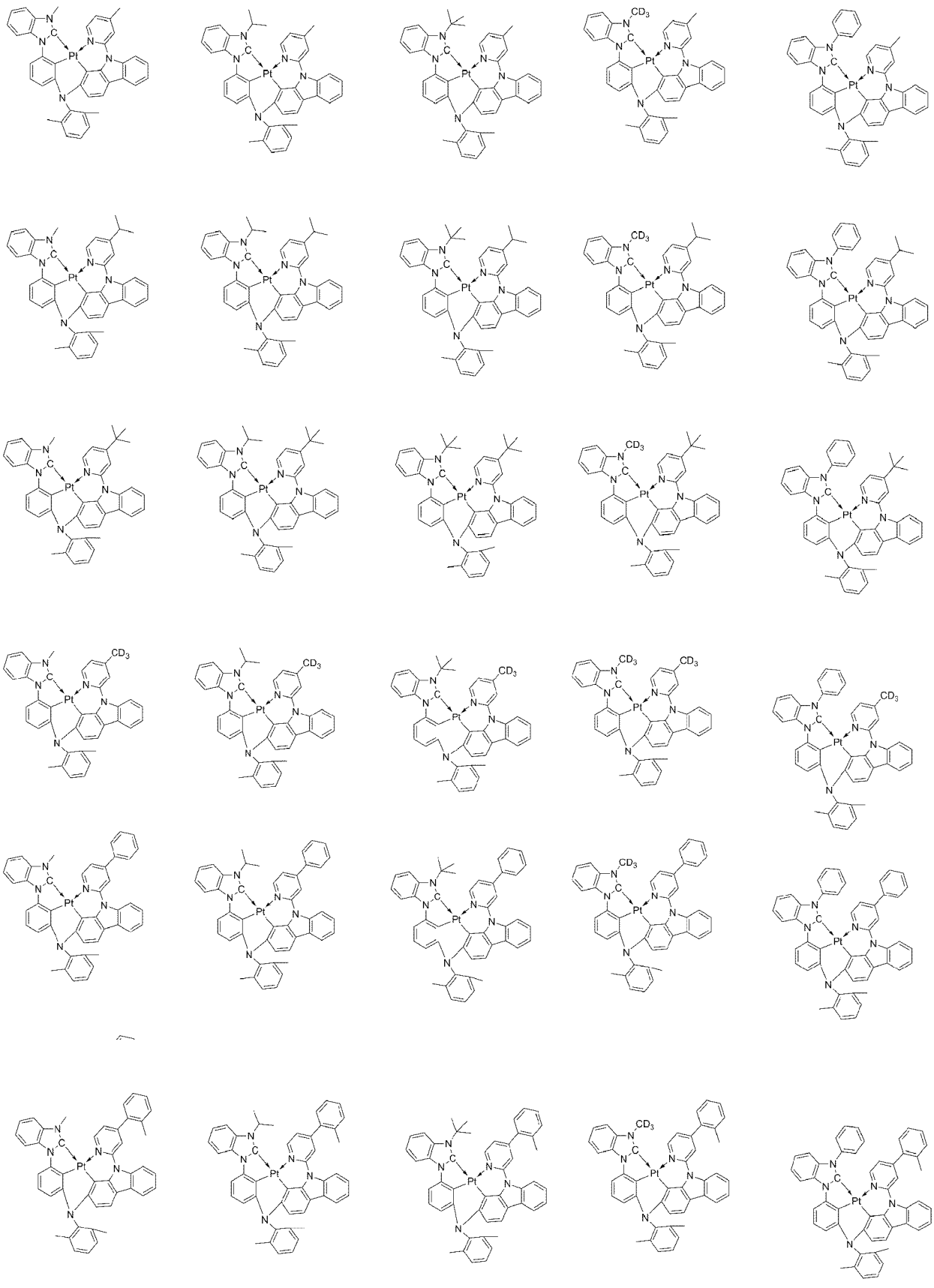


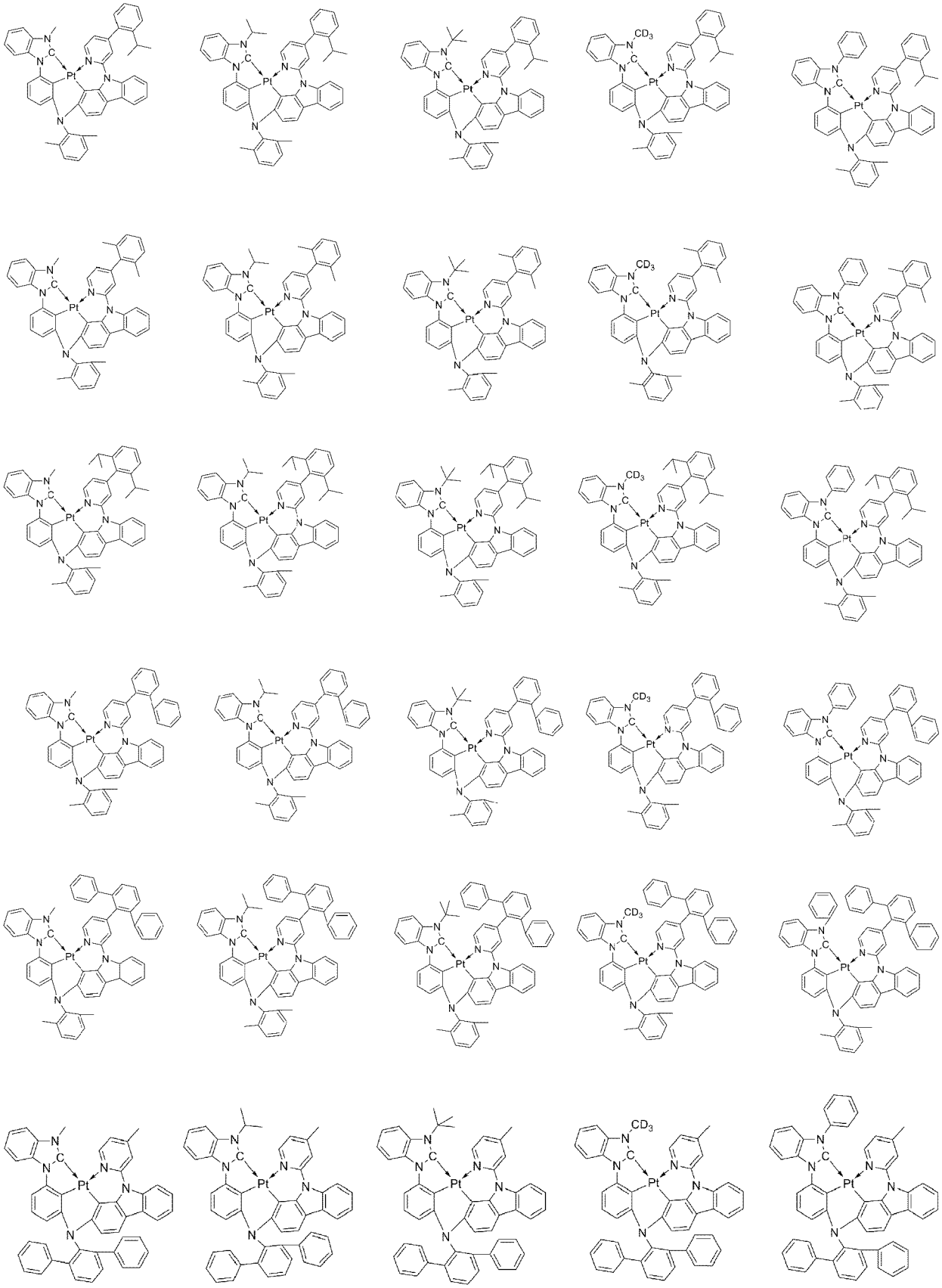


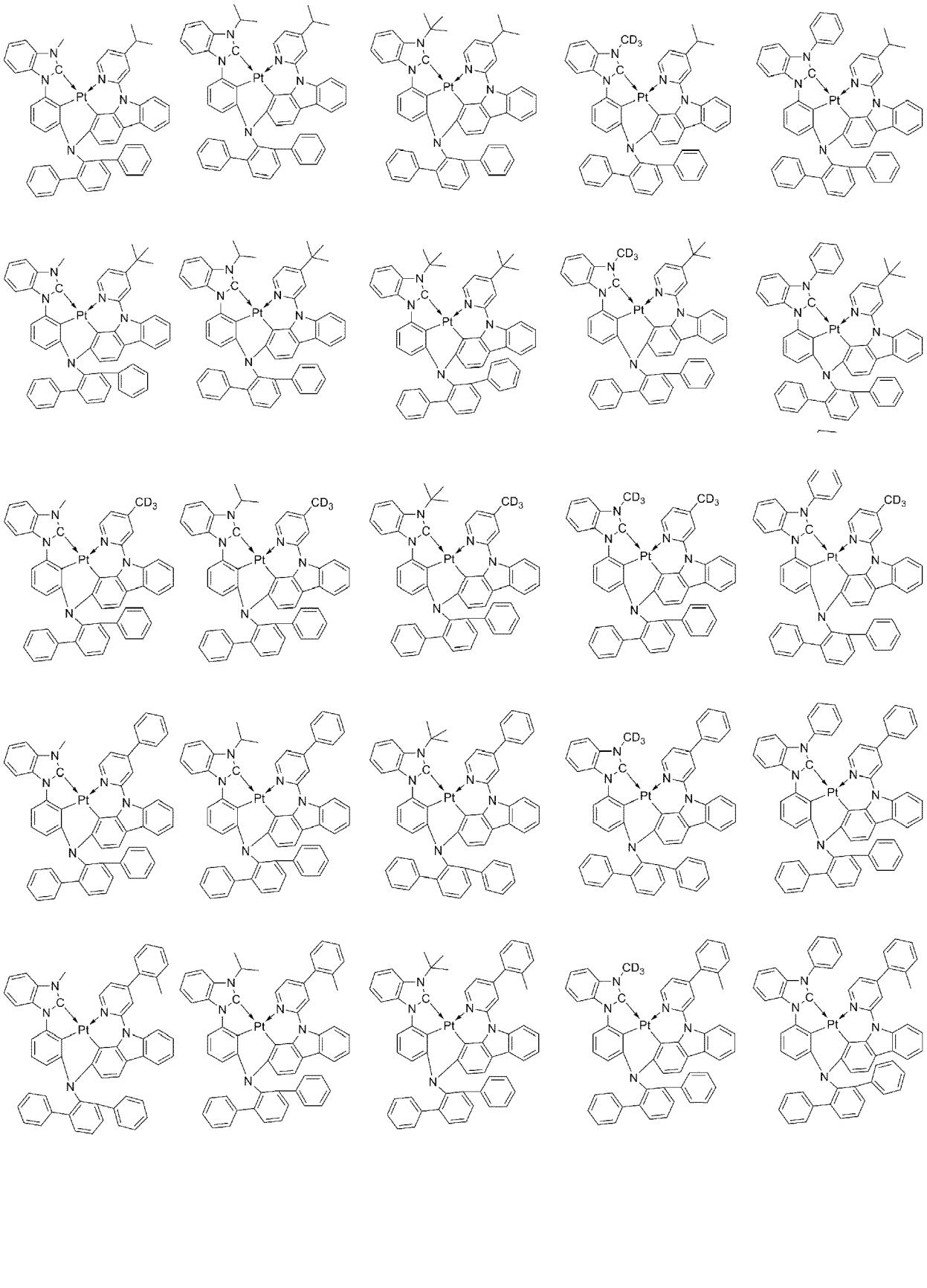


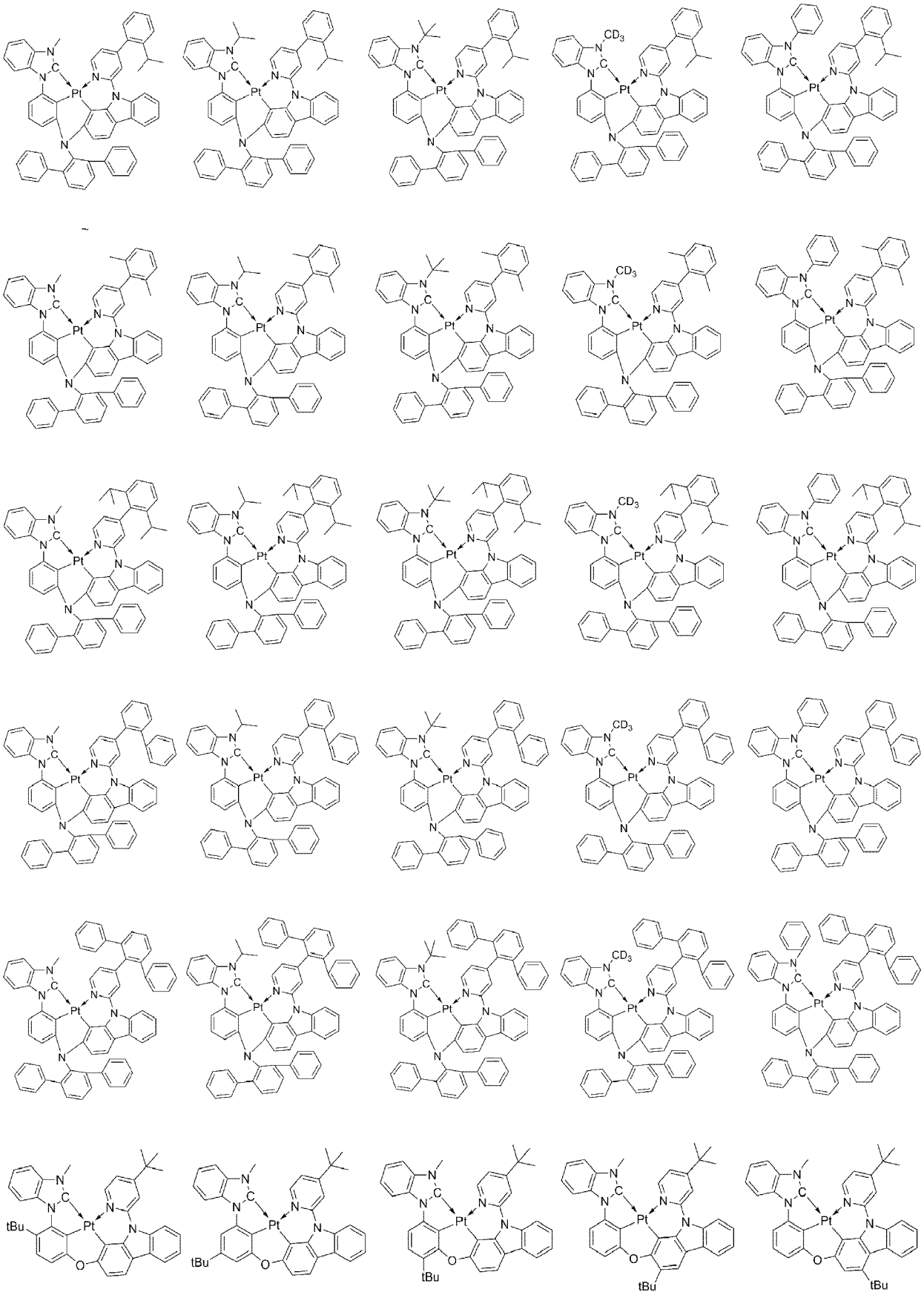


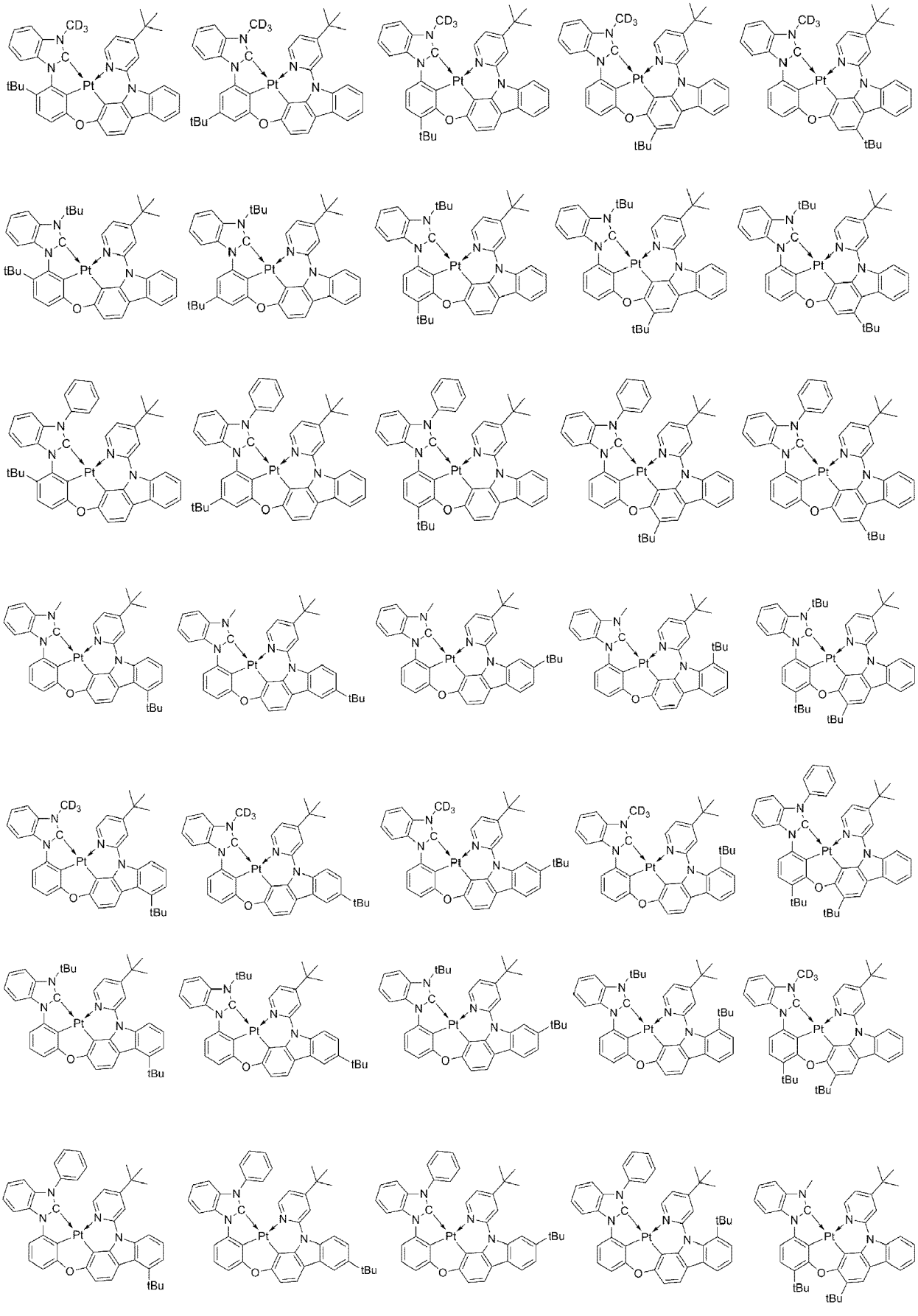


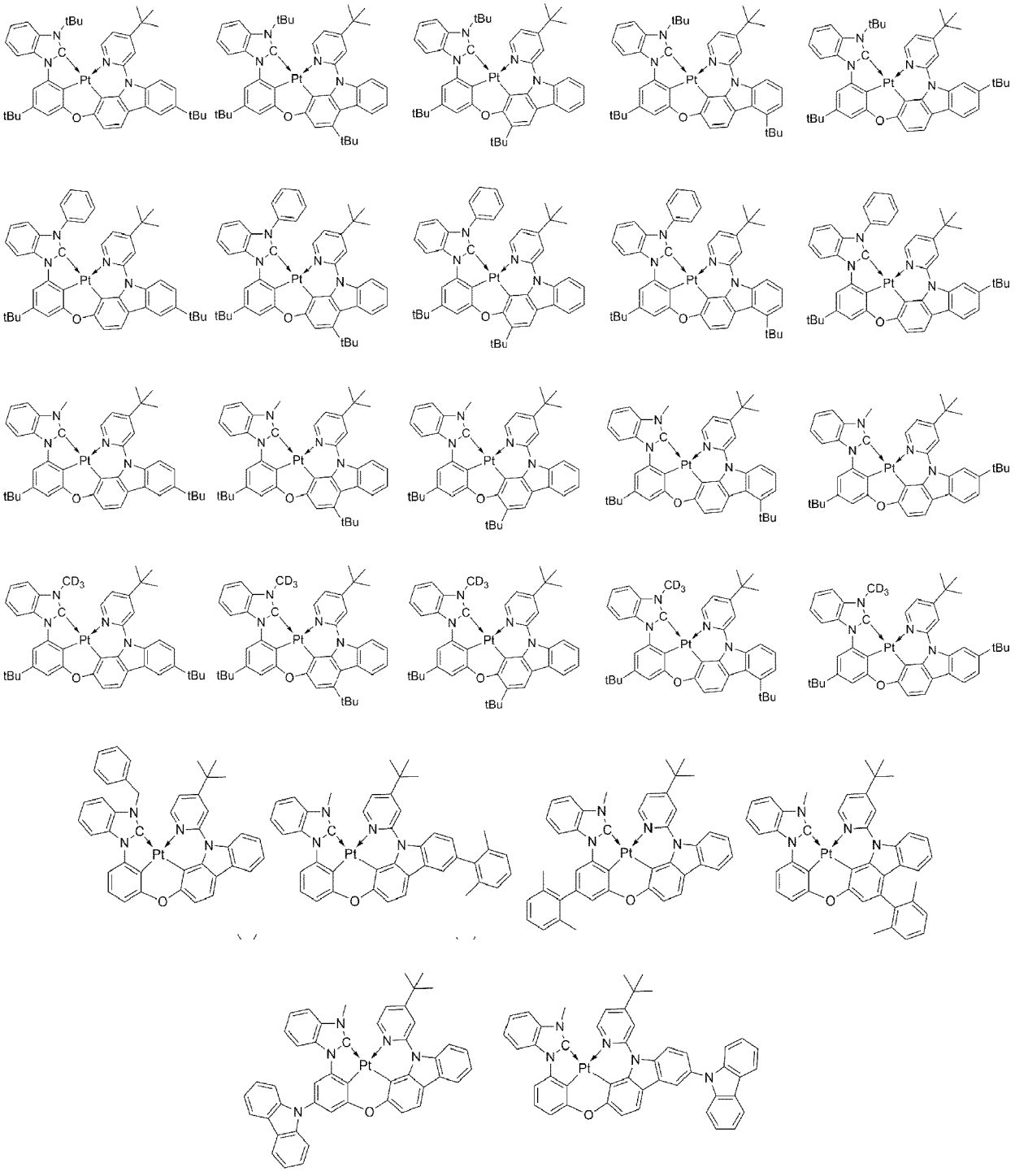












<group V>
a compound represented by Formula A below:

<Formula A> $(L_{101})_{n101}$-M_{101}-$(L_{102})_{m101}$

L_{101}, n101, M_{101}, L_{102}, and m101 in Formula A are the same as shown in Table 1:

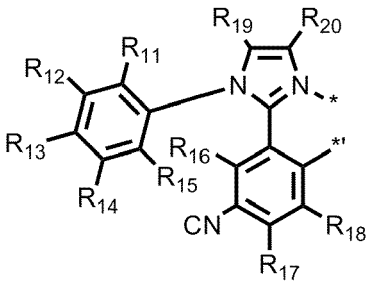
Table 1

Compound name	L_{101}	n101	M_{101}	L_{102}	m101
BD263	LM11	2	Pt	-	0

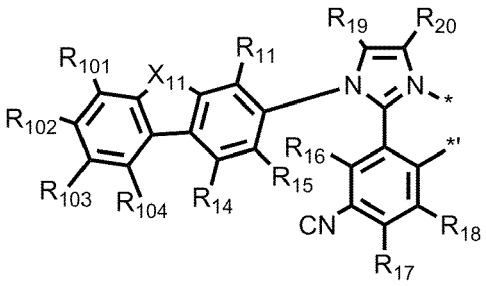
(continued)

Compound name	L_{101}	n101	M_{101}	L_{102}	m101
BD264	LM13	2	Pt	-	0
BD265	LM15	2	Pt	-	0
BD266	LM45	2	Pt	-	0
BD267	LM47	2	Pt	-	0
BD268	LM49	2	Pt	-	0
BD269	LM98	2	Pt	-	0
BD270	LM100	2	Pt	-	0
BD271	LM102	2	Pt	-	0
BD272	LM132	2	Pt	-	0
BD273	LM134	2	Pt	-	0
BD274	LM136	2	Pt	-	0
BD275	LM151	2	Pt	-	0
BD276	LM153	2	Pt	-	0
BD277	LM158	2	Pt	-	0
BD278	LM180	2	Pt	-	0
BD279	LM182	2	Pt	-	0
BD280	LM187	2	Pt	-	0
BD281	LM201	2	Pt	-	0
BD282	LM206	2	Pt	-	0
BD283	LM211	2	Pt	-	0
BD284	LM233	2	Pt	-	0
BD285	LM235	2	Pt	-	0
BD286	LM240	2	Pt	-	0
BD287	LFM5	2	Pt	-	0
BD288	LFM6	2	Pt	-	0
BD289	LFM7	2	Pt	-	0
BD290	LFP5	2	Pt	-	0
BD291	LFP6	2	Pt	-	0
BD292	LFP7	2	Pt	-	0
BD293	LM47	1	Pt	AN1	1
BD294	LM47	1	Pt	AN2	1
BD295	LM47	1	Pt	AN3	1
BD296	LM47	1	Pt	AN4	1
BD297	LM47	1	Pt	AN5	1

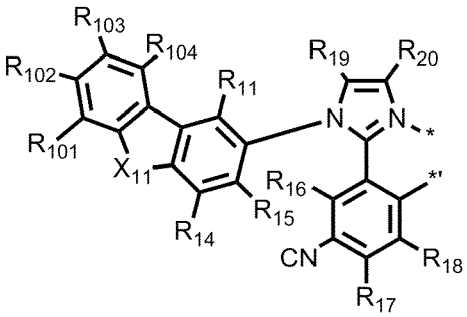
LM11, LM13, LM15, LM45, LM47, LM49, LM98, LM100, LM102, LM132, LM134, LM136, LM151, LM153, LM158, LM180, LM182, LM187, LM201, LM206, LM211, LM233, LM235, LM240, LFM5, LFM6, LFM7, LFP5, LFP6, and LFP7 in Table 1 may be understood by referring to Formulae 1-1 to 1-3 and Tables 2 to 4:



1-1



1-2



1-3

Table 2

Formula 1-1										
Ligand name	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	R_{16}	R_{17}	R_{18}	R_{19}	R_{20}
LM11	Y3	D	Y11	D	Y3	D	D	D	D	D
LM13	Y3	D	Y11	D	Y3	D	Y3	D	D	D
LM15	Y3	D	Y11	D	Y3	D	Y12	D	D	D
LM45	Y3	D	Y12	D	Y3	D	D	D	D	D
LM47	Y3	D	Y12	D	Y3	D	Y3	D	D	D
LM49	Y3	D	Y12	D	Y3	D	Y12	D	D	D
LM98	Y10	D	Y13	D	Y10	D	D	D	D	D
LM100	Y10	D	Y13	D	Y10	D	Y3	D	D	D
LM102	Y10	D	Y13	D	Y10	D	Y12	D	D	D
LM132	Y10	D	Y14	D	Y10	D	D	D	D	D
LM134	Y10	D	Y14	D	Y10	D	Y3	D	D	D
LM136	Y10	D	Y14	D	Y10	D	Y12	D	D	D
LM151	Y3	D	Y15	D	Y3	D	D	D	D	D
LM153	Y3	D	Y15	D	Y3	D	Y3	D	D	D
LM158	Y3	D	Y15	D	Y3	D	Y12	D	D	D
LM180	Y10	D	Y15	D	Y10	D	D	D	D	D
LM182	Y10	D	Y15	D	Y10	D	Y3	D	D	D
LM187	Y10	D	Y15	D	Y10	D	Y12	D	D	D

(continued)

Formula 1-1										
Ligand name	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	R_{16}	R_{17}	R_{18}	R_{19}	R_{20}
LM201	Y3	Y15	D	D	Y3	D	D	D	D	D
LM206	Y3	Y15	D	D	Y3	D	Y3	D	D	D
LM211	Y3	Y15	D	D	Y3	D	Y12	D	D	D
LM233	Y10	Y15	D	D	Y10	D	D	D	D	D
LM235	Y10	Y15	D	D	Y10	D	Y3	D	D	D
LM240	Y10	Y15	D	D	Y10	D	Y12	D	D	D

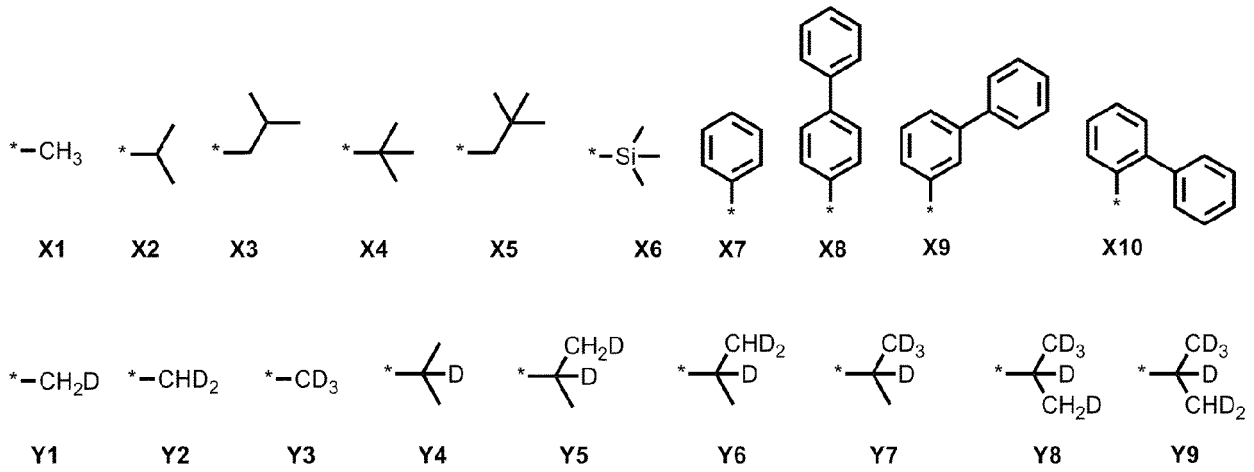
[Table 3]

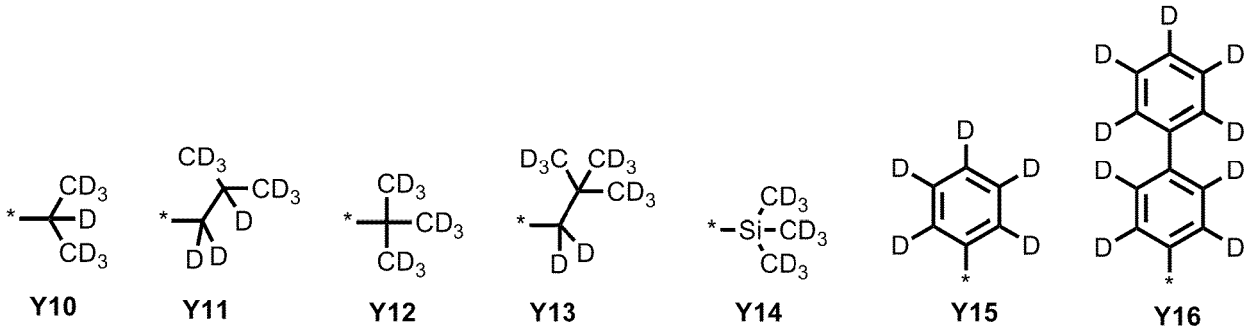
Formula 1-2													
Ligand name	R_{11}	X_{11}	R_{101}	R_{102}	R_{103}	R_{104}	R_{14}	R_{15}	R_{16}	R_{17}	R_{18}	R_{19}	R_{20}
LFM5	Y10	O	D	D	D	D	D	Y10	D	D	D	D	D
LFM6	Y10	O	D	D	D	D	D	Y10	D	Y3	D	D	D
LFM7	Y10	O	D	D	D	D	D	Y10	D	Y12	D	D	D

Table 4

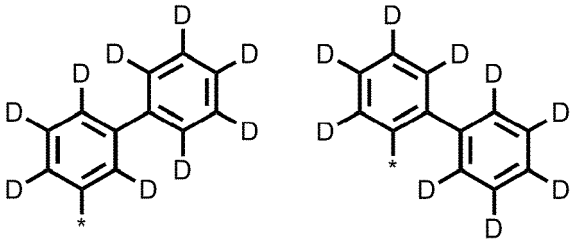
Formula 1-3													
Ligand name	R_{11}	X_{11}	R_{101}	R_{102}	R_{103}	R_{104}	R_{14}	R_{15}	R_{16}	R_{17}	R_{18}	R_{19}	R_{20}
LFP5	Y10	O	D	D	D	D	D	Y10	D	D	D	D	D
LFP6	Y10	O	D	D	D	D	D	Y10	D	Y3	D	D	D
LFP7	Y10	O	D	D	D	D	D	Y10	D	Y12	D	D	D

Y1 to Y18 in Tables 2 to 4 are the same as below:



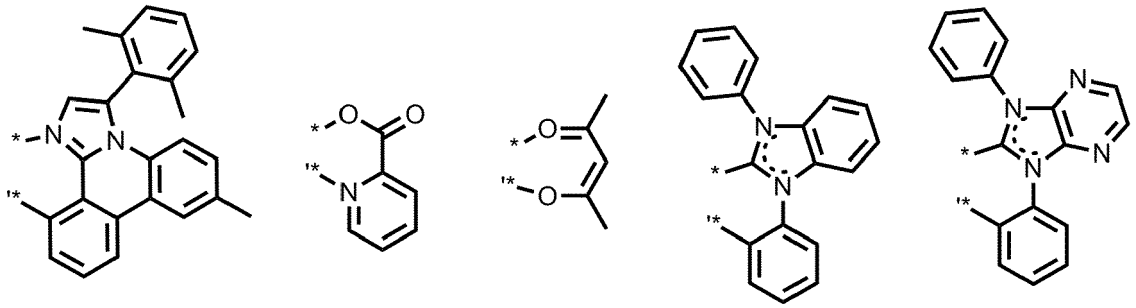


Y10 Y11 Y12 Y13 Y14 Y15 Y16



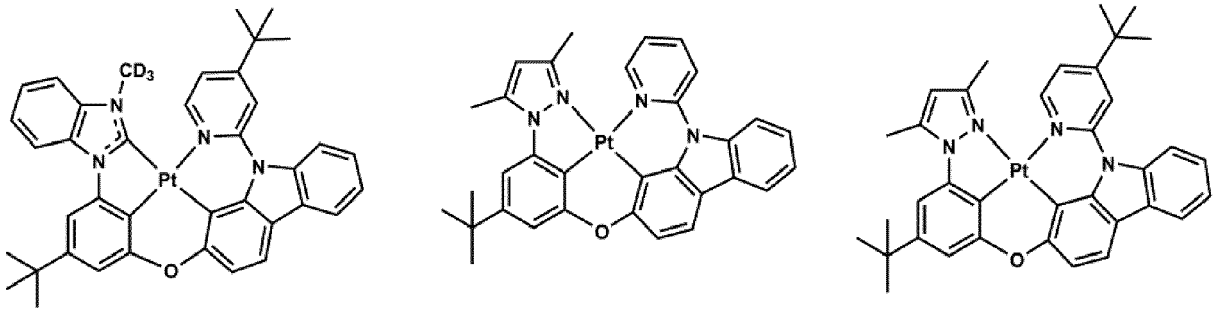
Y17 Y18

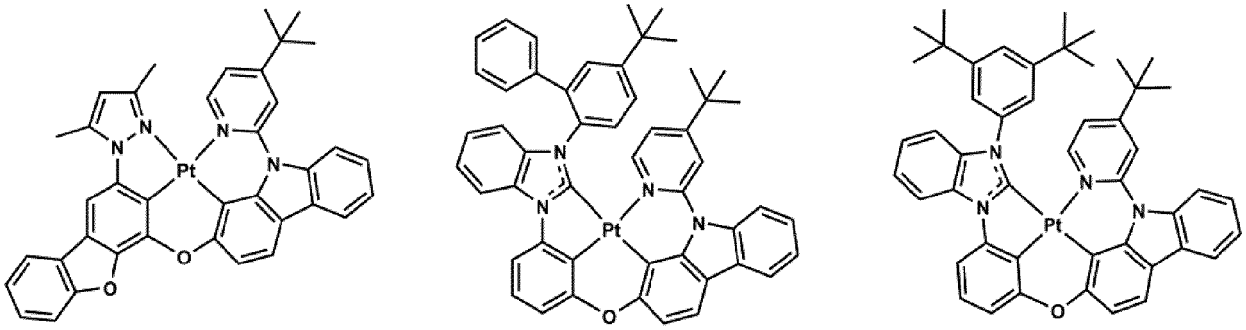
AN1 to AN5 in Table 1 are the same as below:



AN1 AN2 AN3 AN4 AN5

<group VI>





[0091] In one or more embodiments, the sensitizer may be a thermally activated delayed fluorescence emitter. Thermally activated delayed fluorescence emitter may not include metal. In one embodiment, thermally activated delayed fluorescence emitter may satisfy Condition 7:

<Condition 7>

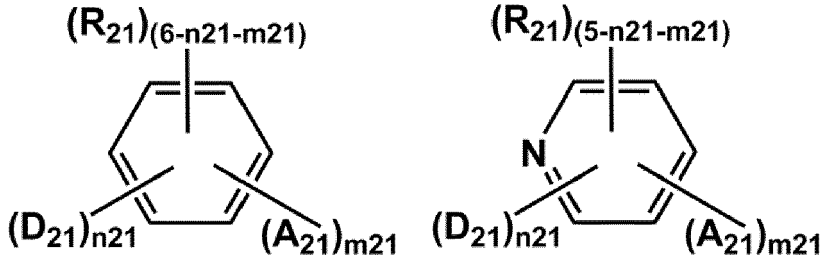
$$\Delta E_{ST} \leq 0.3 \text{ eV}$$

wherein, in Condition 7,

ΔE_{ST} is the difference between the lowest excitation singlet energy level and the lowest excitation triplet energy level of the sensitizer.

[0092] In one embodiment, the sensitizer may include thermally activated delayed fluorescence emitter represented by Formula 201 or 202:

<Formula 201> <Formula 202>



In Formulae 201 and 202,

A_{21} is an acceptor group,

D_{21} is a donor group,

m21 may be 1, 2, or 3, and n21 may be 1, 2, or 3,

the sum of n21 and m21 in Formula 201 may be 6 or less, and the sum of n21 and m21 in Formula 202 may be 5 or less,

R_{21} may be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, SF_5, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a substituted or unsubstituted C_1-C_{60} alkyl group, a substituted or unsubstituted C_2-C_{60} alkenyl group, a substituted or unsubstituted C_2-C_{60} alkynyl group, a substituted or unsubstituted C_1-C_{60} alkoxy group, a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_7-C_{60} alkylaryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted C_2-C_{60} alkylheteroaryl group, a substituted or unsubstituted C_1-C_{60}heteroaryloxy group, a substituted or unsubstituted C_1-C_{60} heteroarylthio group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group, -Si(Q_1)(Q_2)(Q3), -B(Q_1)(Q_2), -N(Q_1)(Q_2), -P(Q_1)(Q_2), -C(=O)(Q_1), -S(=O)(Q_1), -S(=O)$_2$(Q_1), -P(=O)(Q_1)(Q_2), and -P(=S)(Q_1)(Q_2), a plurality of R_{21} may optionally be linked together to form a substituted or unsubstituted C_5-C_{30}

carbocyclic group or a substituted or unsubstituted C_1-C_{30} heterocyclic group,

Q_1 to Q_3 may each independently selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10}heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_7-C_{60} alkyl aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a C_2-C_{60} alkyl heteroaryl group, a C_1-C_{60} heteroaryloxy group, a C_1-C_{60} heteroarylthio group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group, a C_1-C_{60} alkyl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group, and a C_6-C_{60} aryl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group.

[0093] For example, A_{21} in Formula 201 and 202 may be a substituted or unsubstituted π electron-deficient nitrogen-free cyclic group.

[0094] In one embodiment, the π electron-deficient nitrogen-free cyclic group may be selected from a benzene group, a heptalene group, an indene group, a naphthalene group, an azulene group, an indacene group, acenaphthylene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentacene group, a hexacene group, a pentaphene group, a rubicene group, a coronene group, an ovalene group, a pyrrole group, an isoindole group, an indole group, a furan group, a thiophene group, a benzofuran group, a benzothiophene group, a benzocarbazole group, a dibenzocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzothiophene sulfone group, a carbazole group, a dibenzosilole group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, a benzothienocarbazole group, a triindolobenzene group; and a condensed cyclic group of two or more π electron-deficient nitrogen-free cyclic groups, but embodiments of the present disclosure are not limited thereto.

[0095] For example, D_{21} in Formulae 201 and 202 may be selected from: -F, a cyano group, and an π-electron deficient nitrogen-containing cyclic group;

a C_1-C_{60} alkyl group, a π-electron deficient nitrogen-containing cyclic group, and a π electron-deficient nitrogen-free cyclic group, each substituted with at least one selected from -F and a cyano group; and

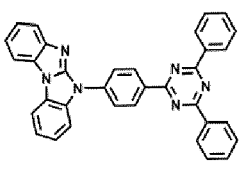
a π-electron deficient nitrogen-containing cyclic group, each substituted with at least one selected from deuterium, a C_1-C_{60} alkyl group, an π-electron deficient nitrogen-containing cyclic group, and an π electron-deficient nitrogen-free cyclic group.

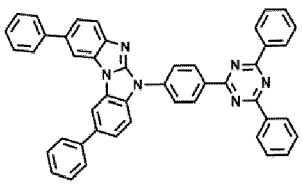
[0096] In one embodiment, the π electron-deficient nitrogen-free cyclic group is the same as described above.

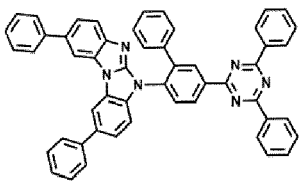
[0097] The term "π electron-deficient nitrogen-containing cyclic group" used herein refers to a cyclic group having at least one *-N=*' moiety, and, for example, may be selected from an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyridazine group, a pyrimidine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, an azacarbazole group, and a benzimidazolobenzimidazole group; and a condensed cyclic group in which two or more π electron-deficient nitrogen-containing cyclic groups are condensed with each other.

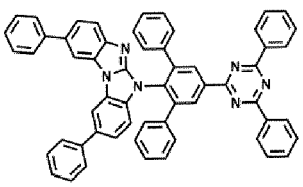
[0098] In one or more embodiments, the sensitizer may be selected from Groups VII to XI, but embodiments of the present disclosure are not limited thereto:

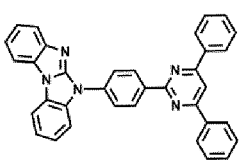
<group VII>

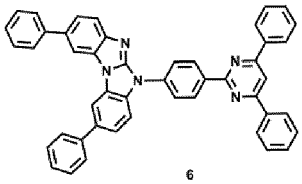

1

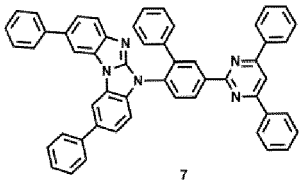

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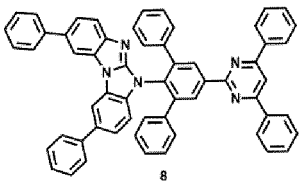

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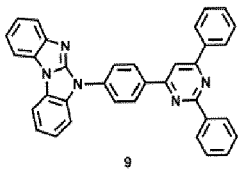

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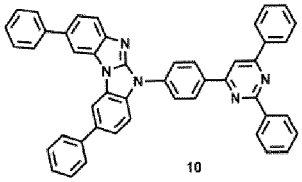

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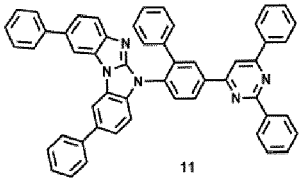

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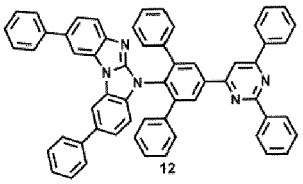

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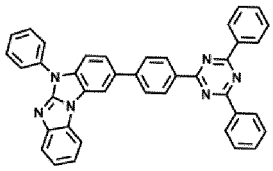

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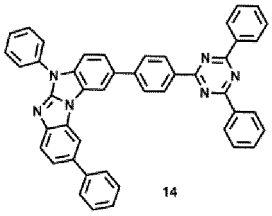

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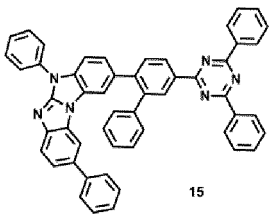

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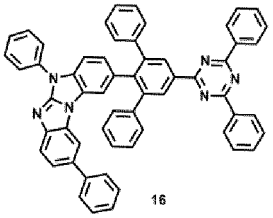

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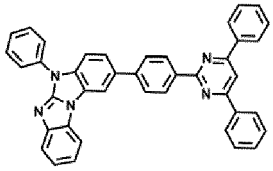

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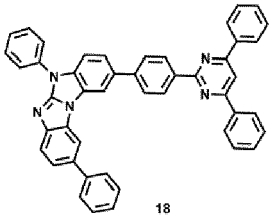

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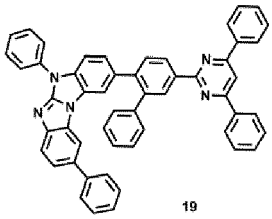

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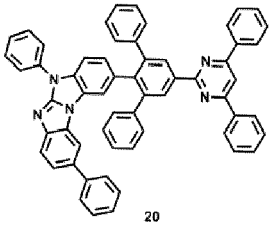

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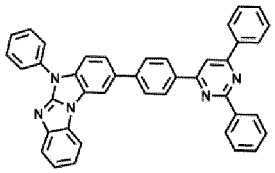

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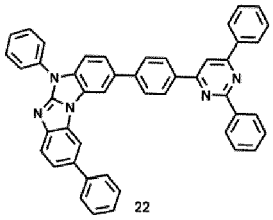

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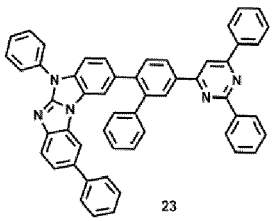

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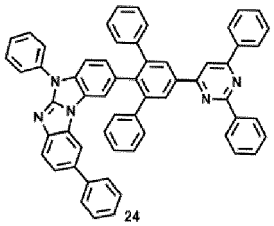

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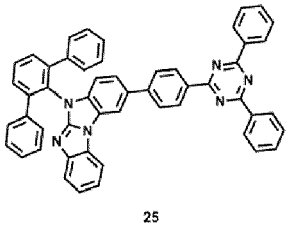

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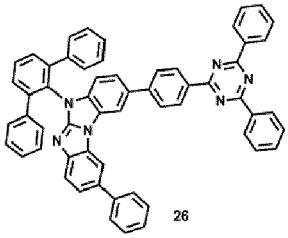

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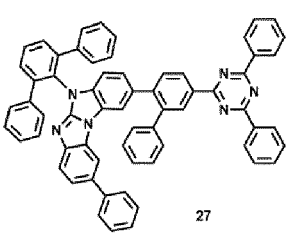

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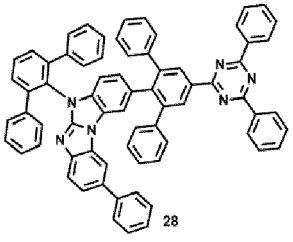

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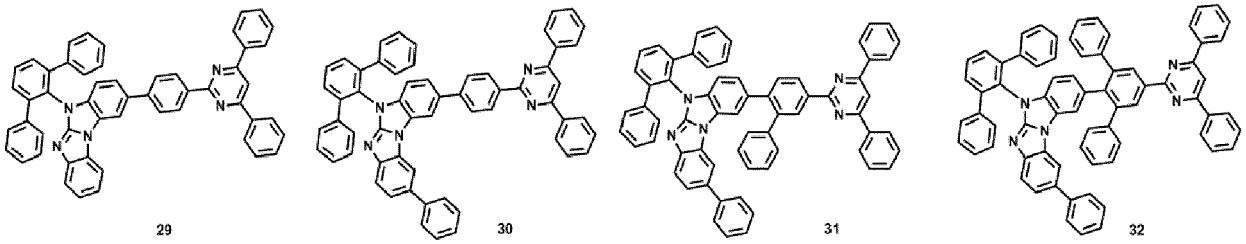

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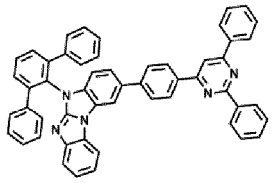

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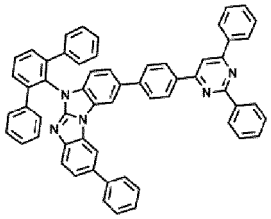

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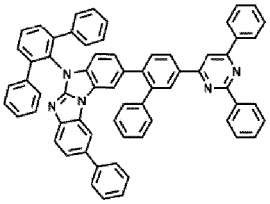
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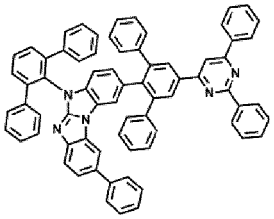
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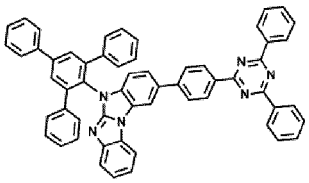
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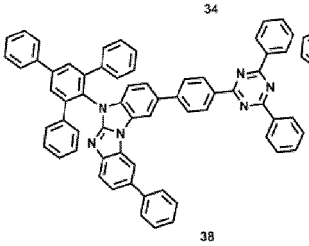

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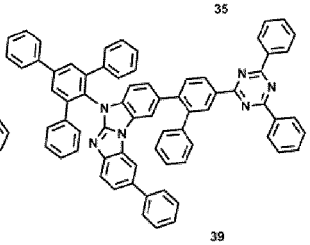

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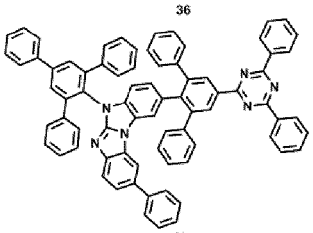

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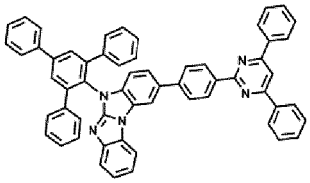

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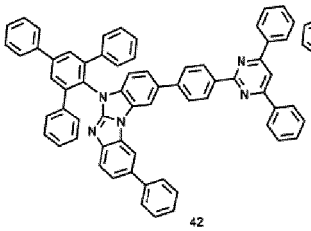

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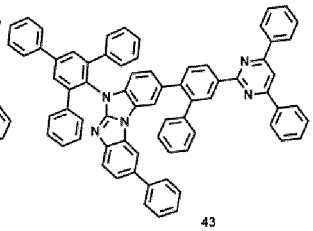

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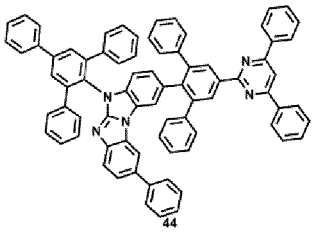

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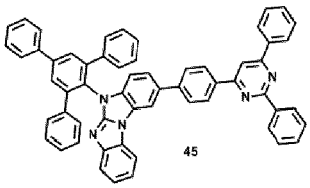

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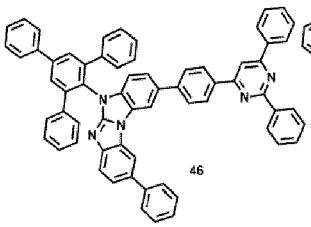

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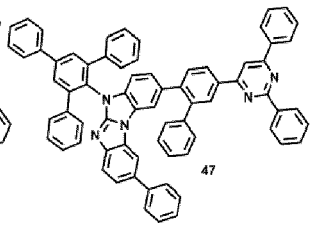

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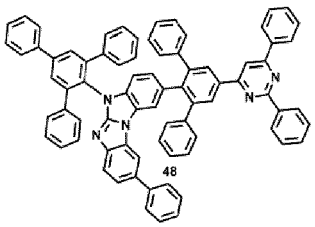

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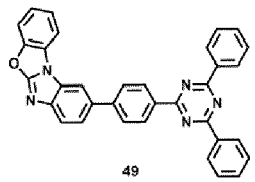

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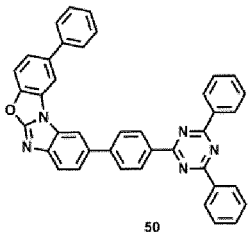

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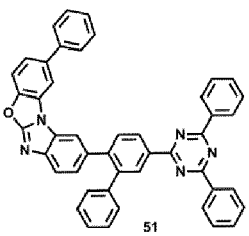

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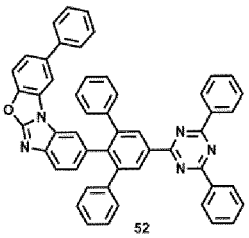

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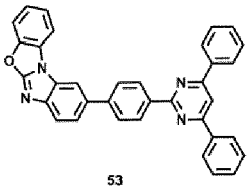

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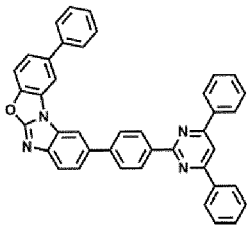

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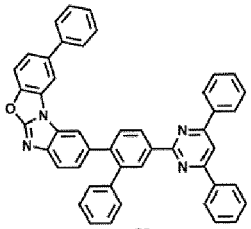

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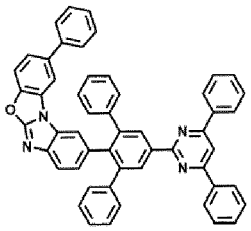

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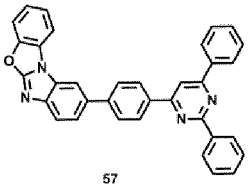

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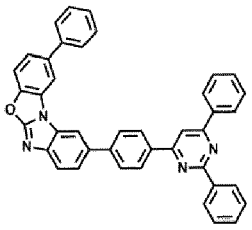

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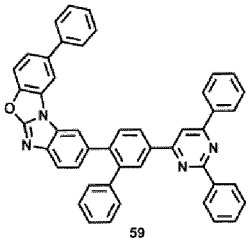

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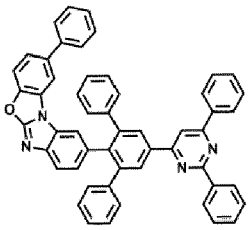

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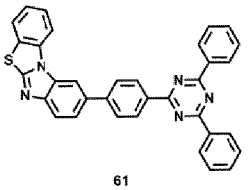

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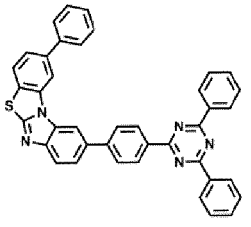

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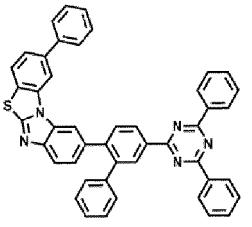

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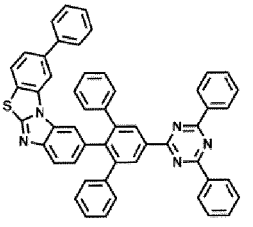

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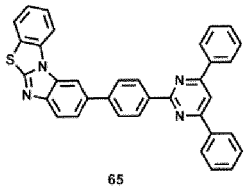

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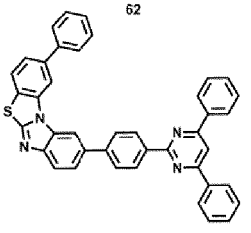

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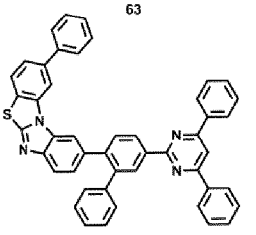

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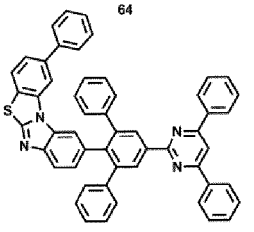

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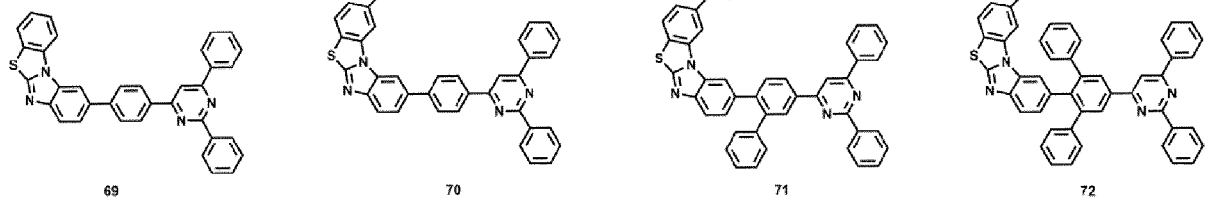

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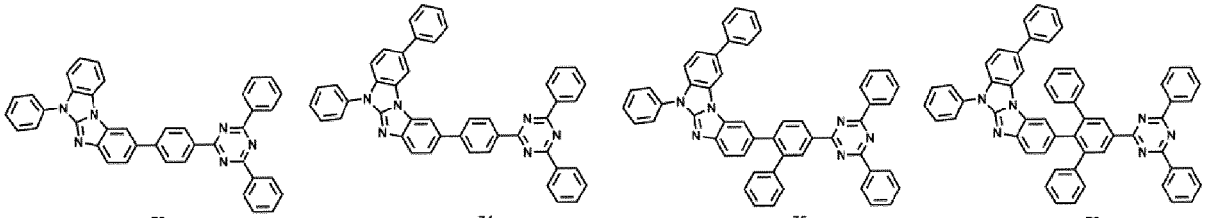

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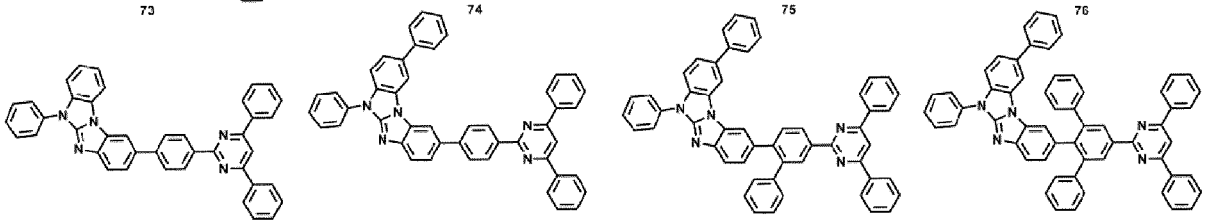

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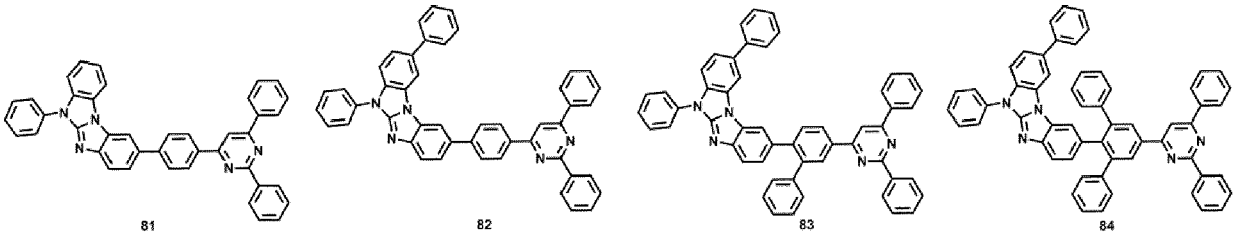

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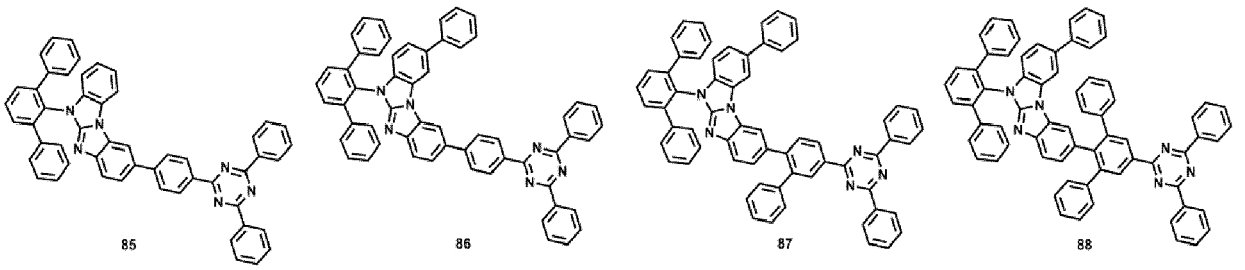

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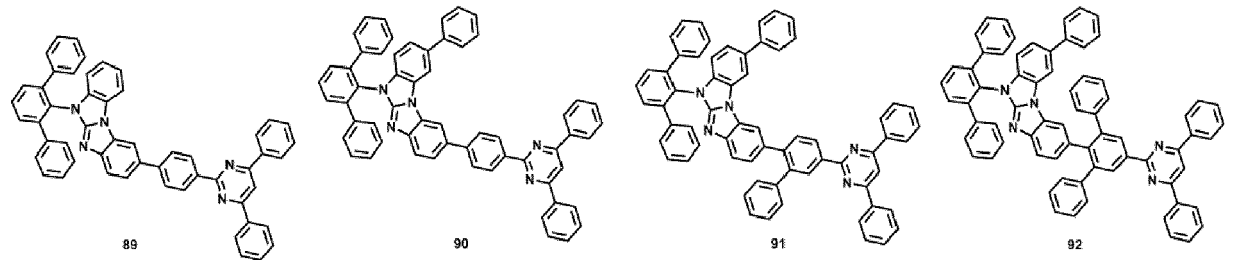

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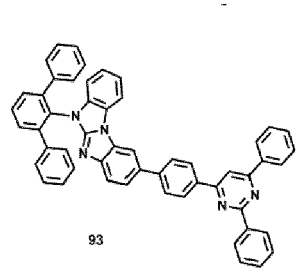

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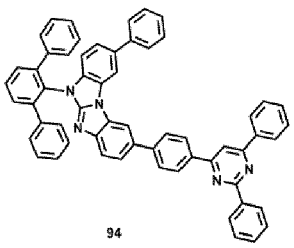

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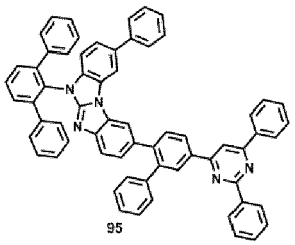

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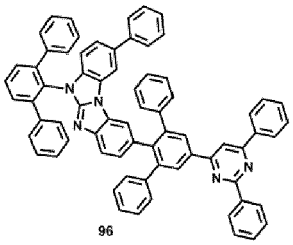

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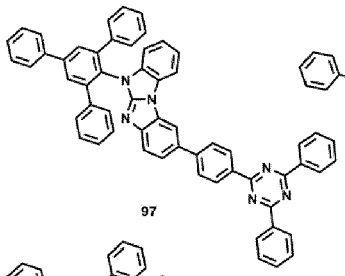

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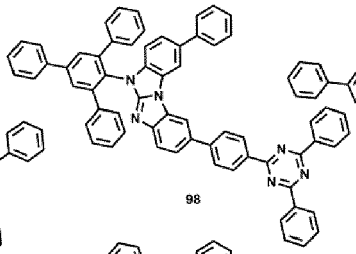

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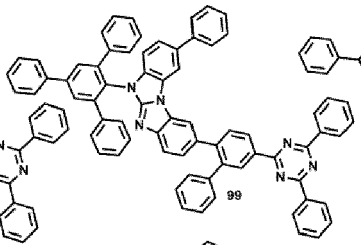

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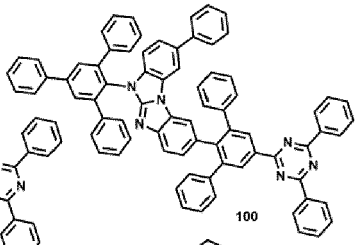

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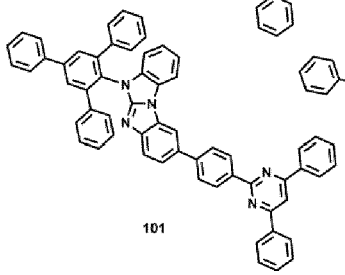

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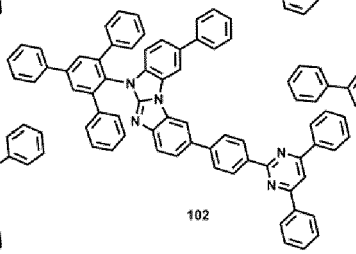

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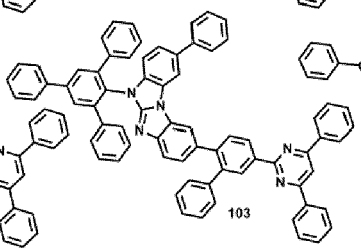

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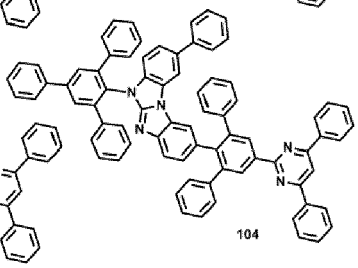

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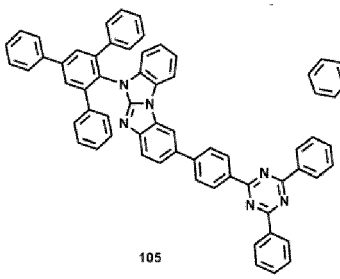

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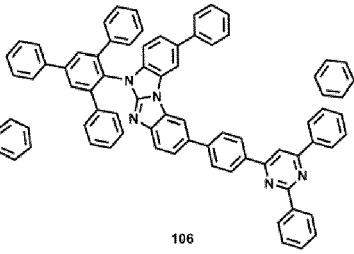

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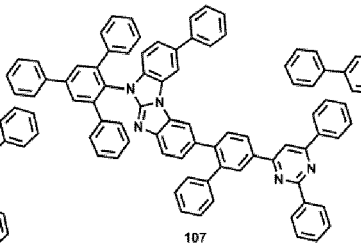

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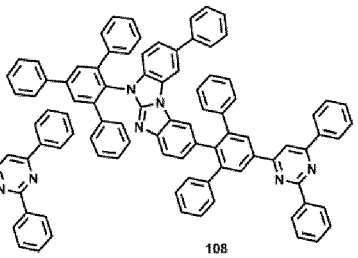

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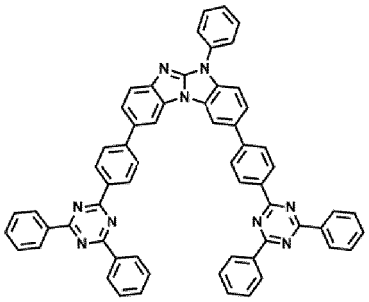

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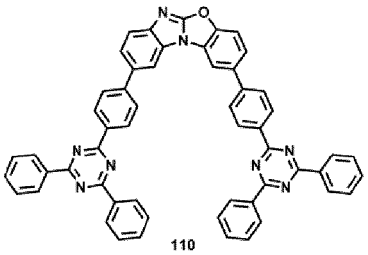

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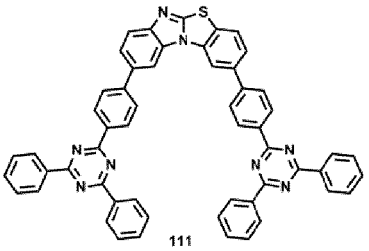

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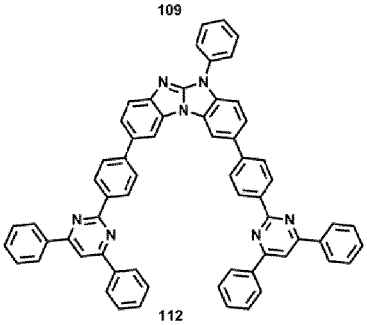

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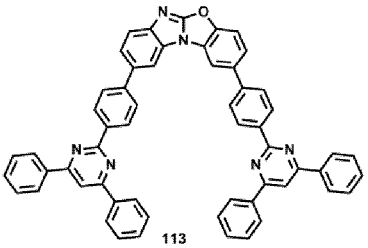

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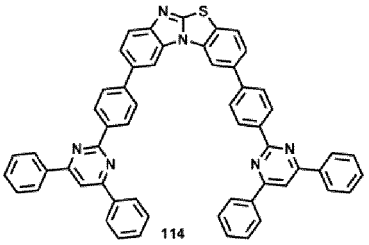

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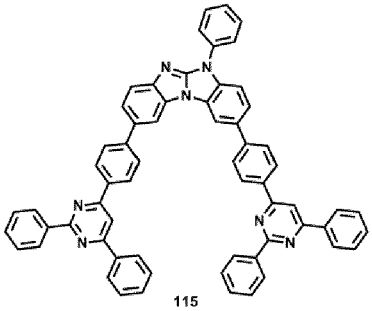

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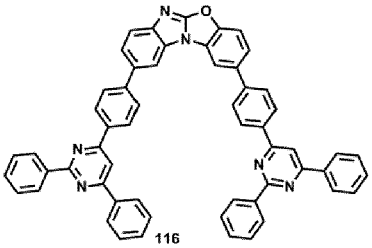

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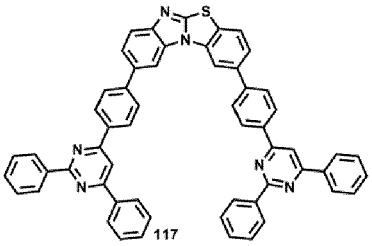

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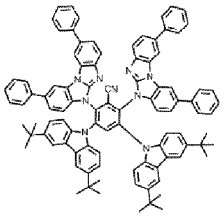

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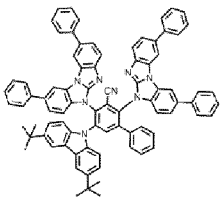

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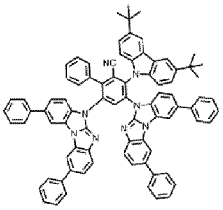

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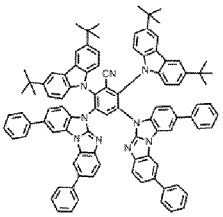

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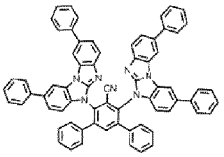
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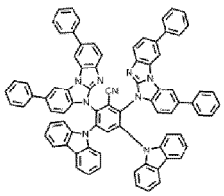


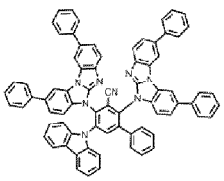


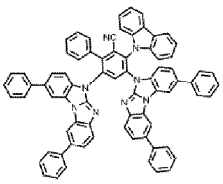


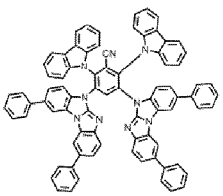


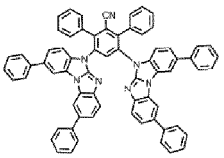


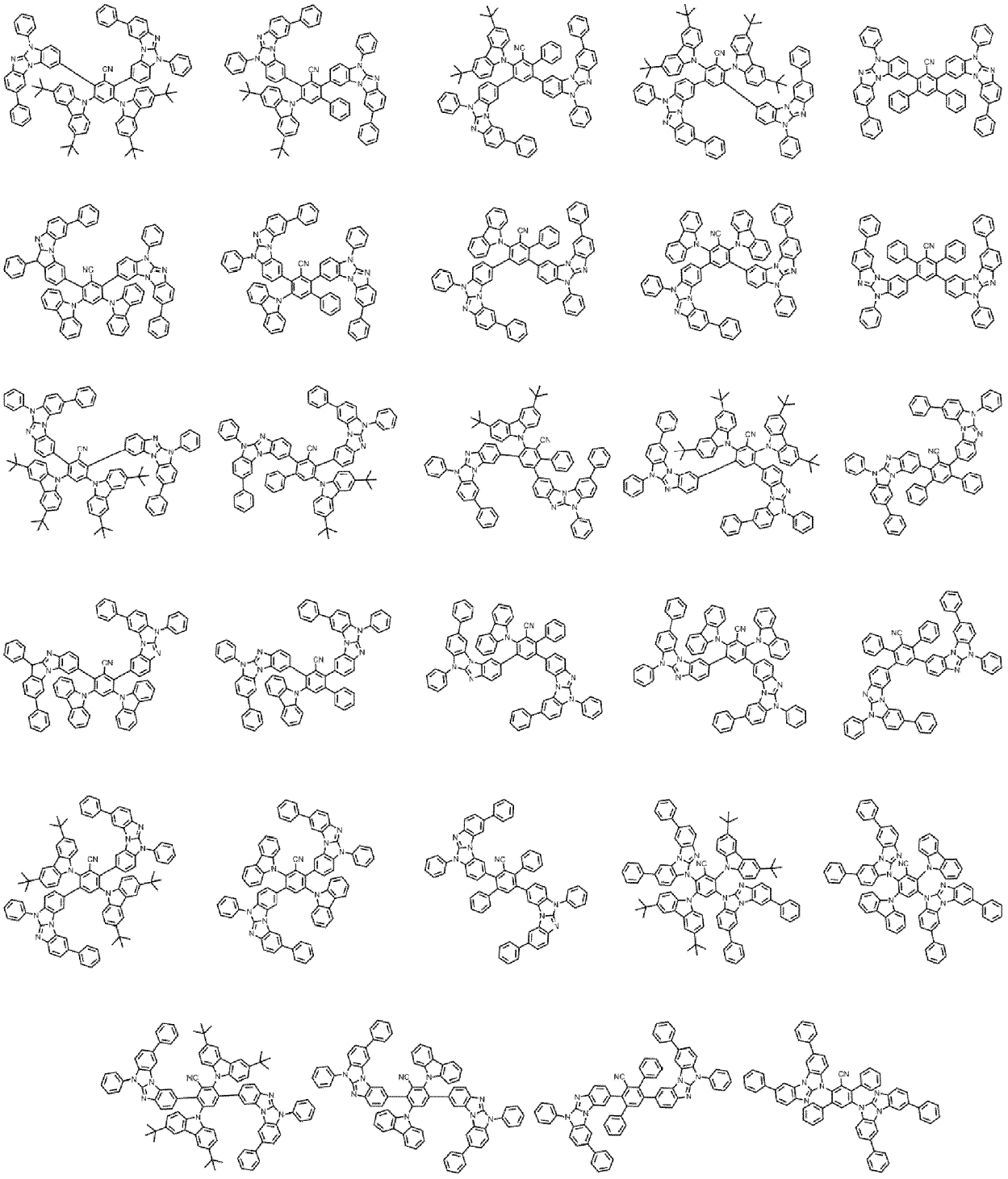




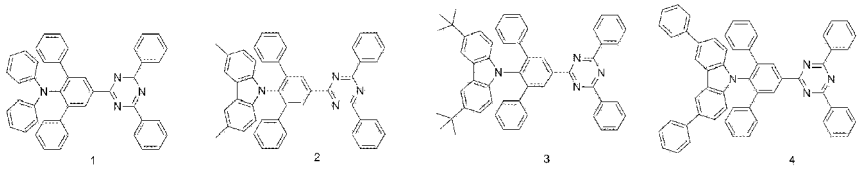


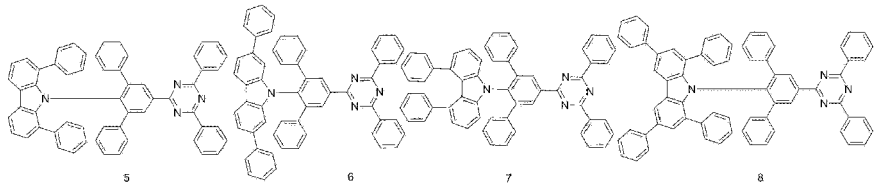




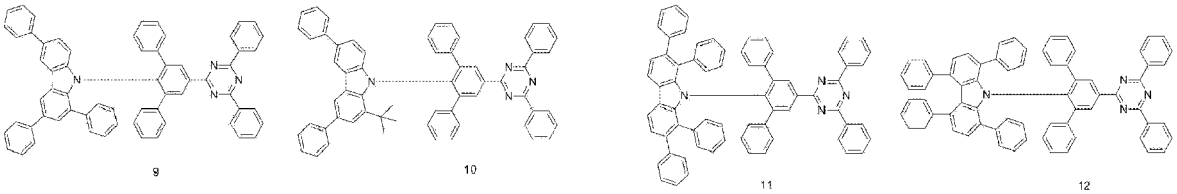


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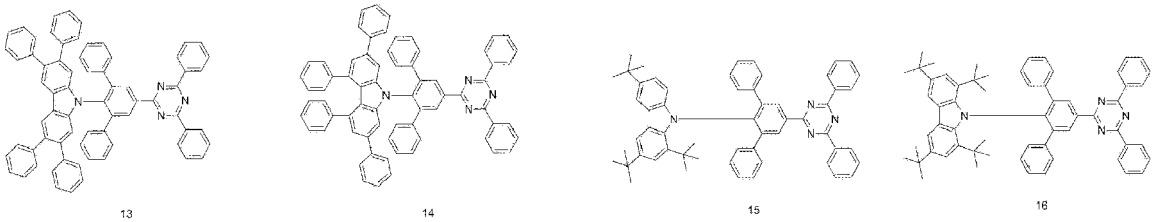




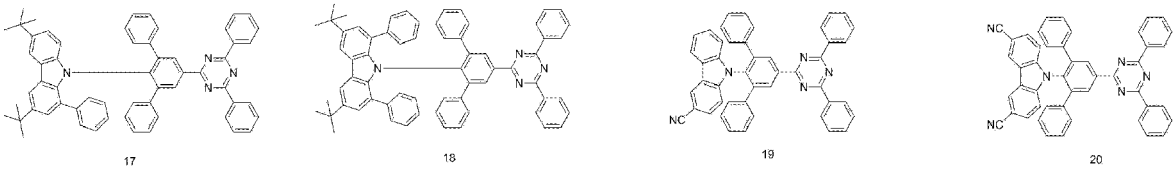
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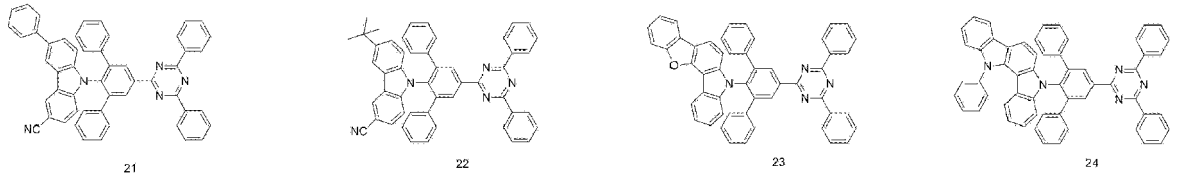
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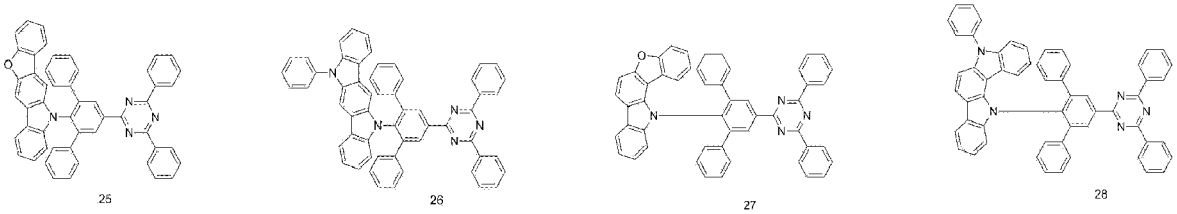
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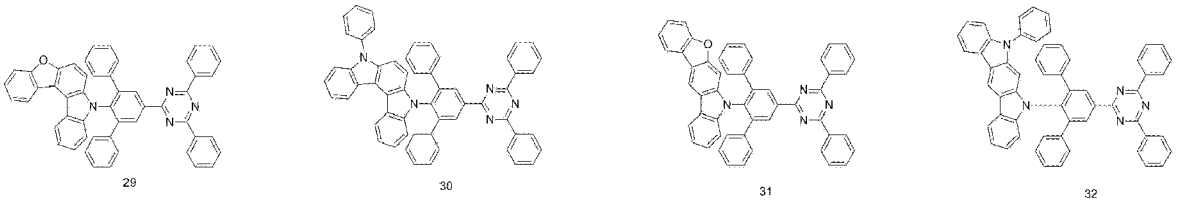
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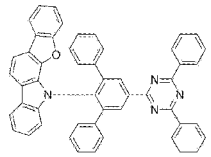
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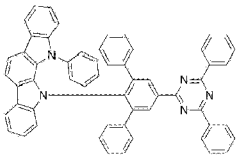


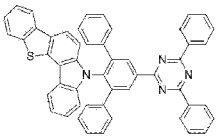
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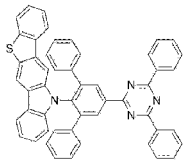


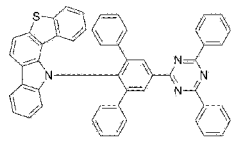
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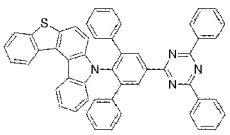

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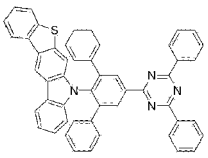

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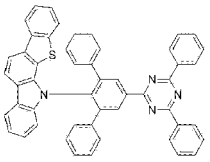

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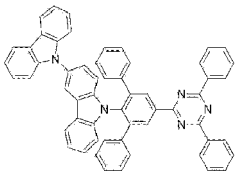

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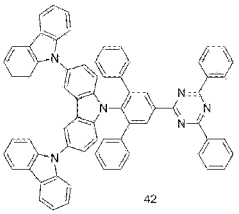

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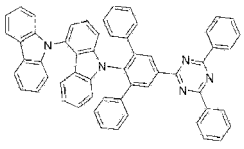

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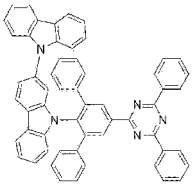

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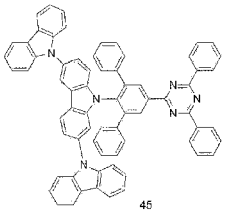

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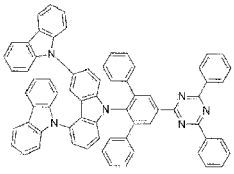

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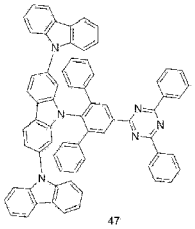

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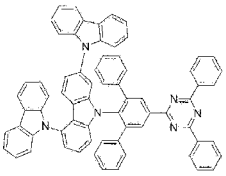

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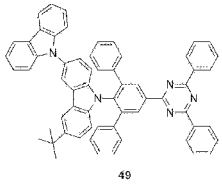

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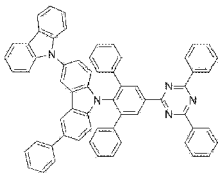

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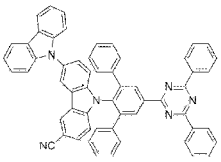

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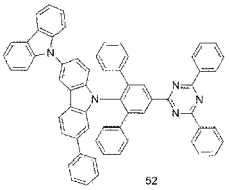

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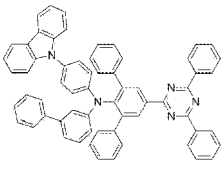

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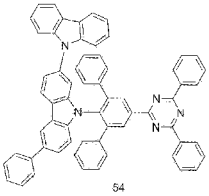

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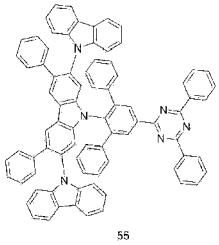

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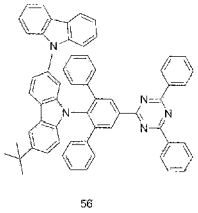

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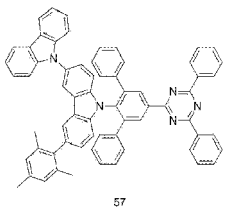

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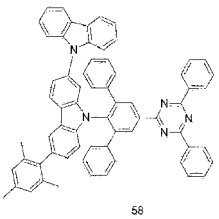

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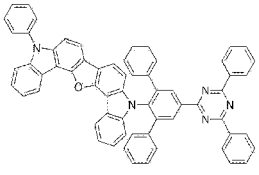

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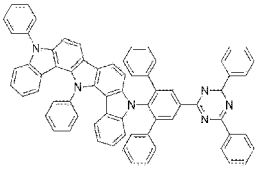

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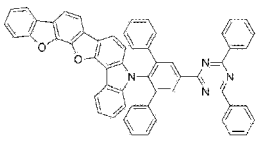

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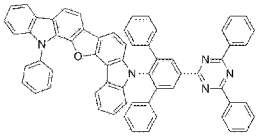

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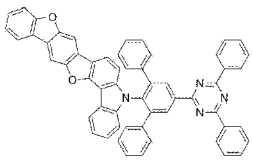

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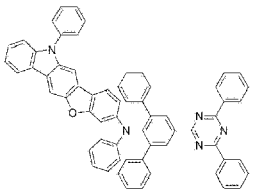

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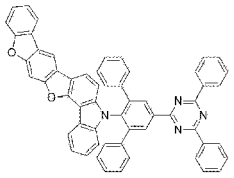

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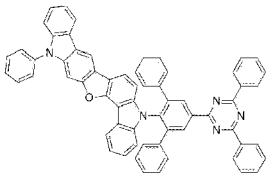

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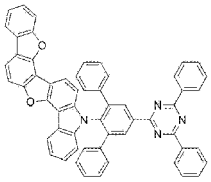

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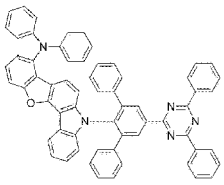

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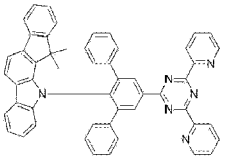

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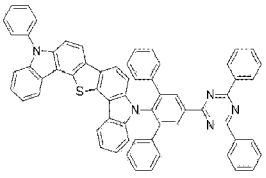

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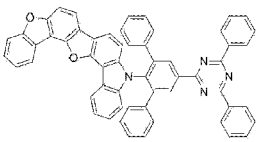

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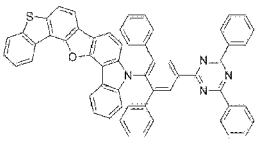

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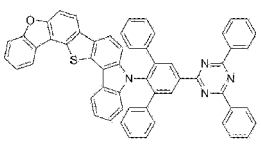

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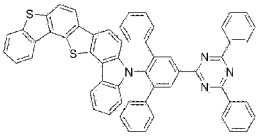

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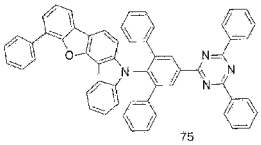

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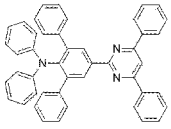

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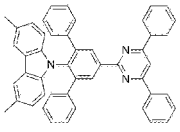

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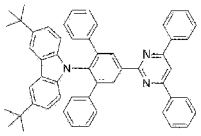

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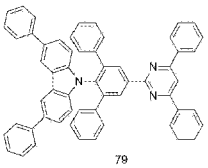

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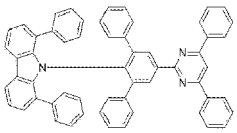

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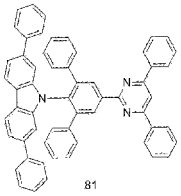

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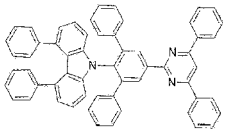

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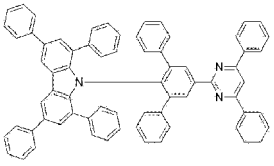

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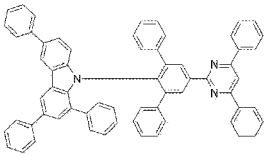

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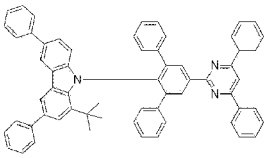

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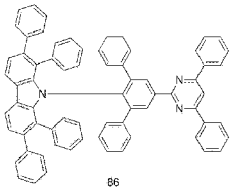

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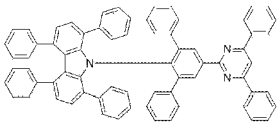

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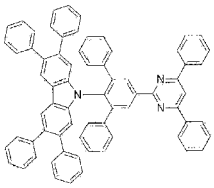

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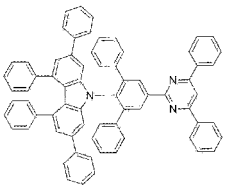

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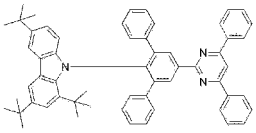

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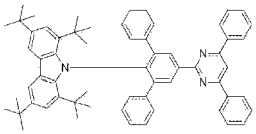

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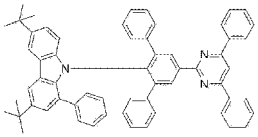

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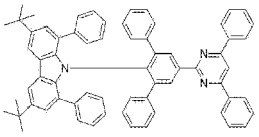

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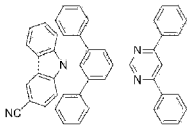

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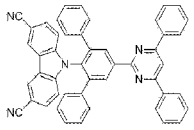

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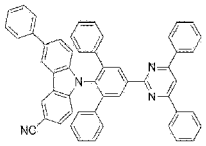

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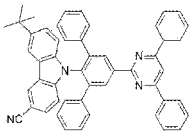

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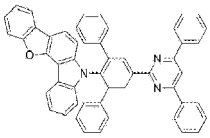

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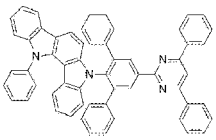

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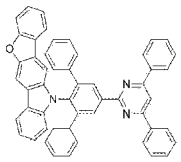

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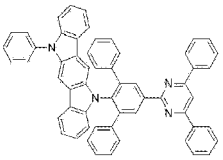

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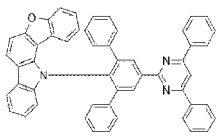

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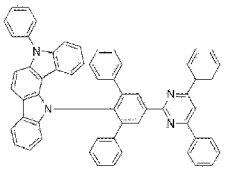

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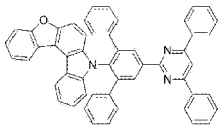

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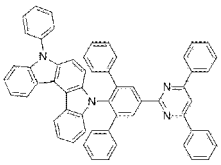

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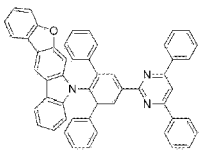

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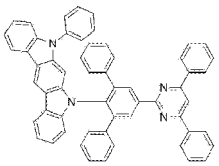

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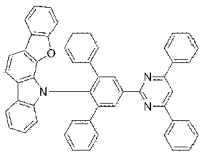

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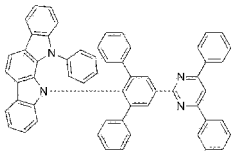

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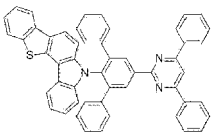

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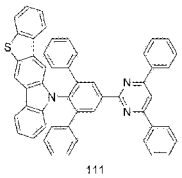

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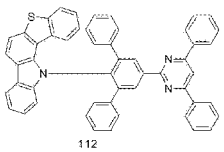

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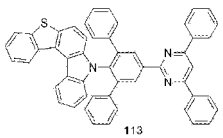

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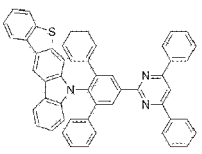

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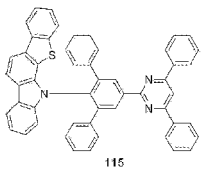

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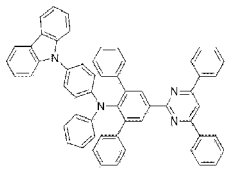

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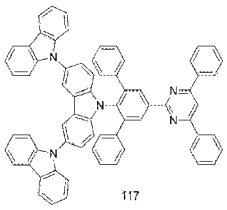

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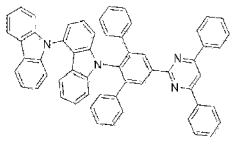

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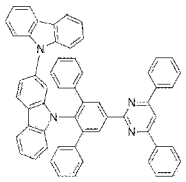

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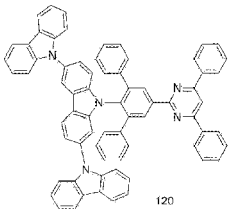

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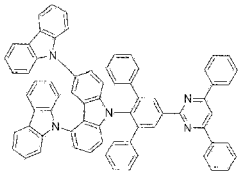

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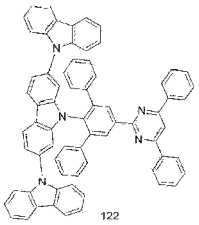

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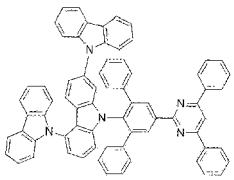

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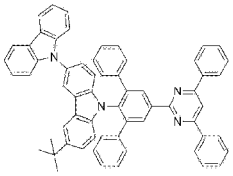

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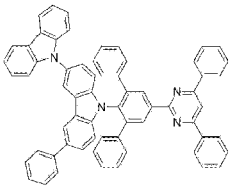

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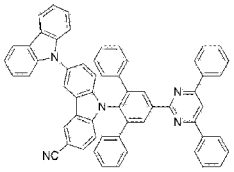

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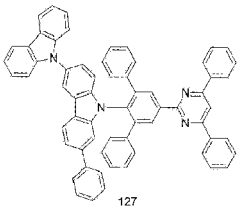

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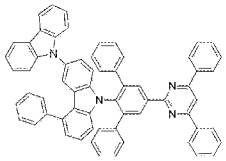

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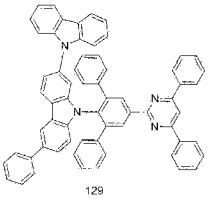

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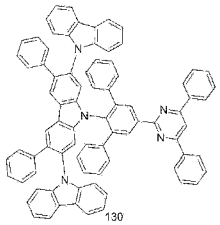

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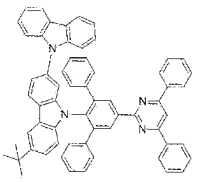

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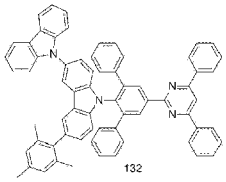

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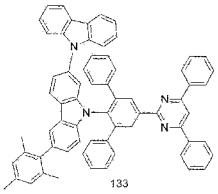

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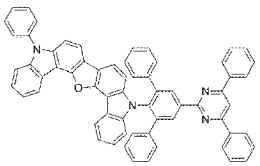

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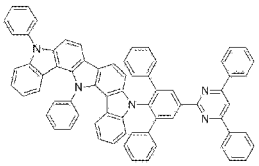

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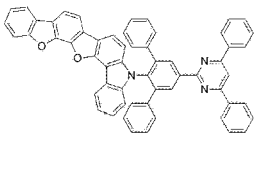

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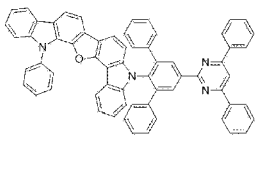

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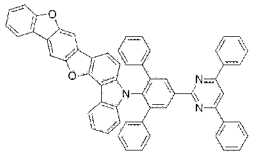

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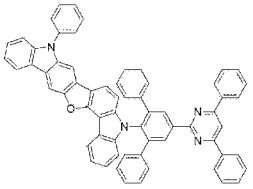

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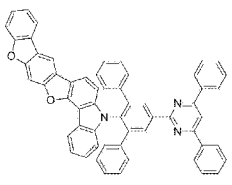

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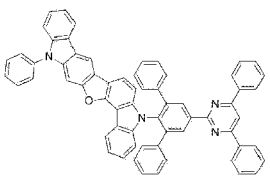

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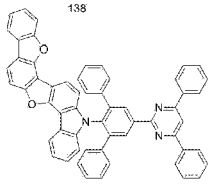

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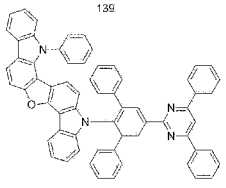

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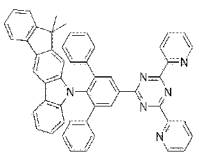

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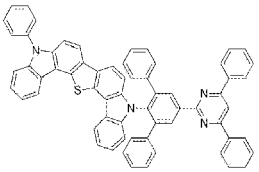

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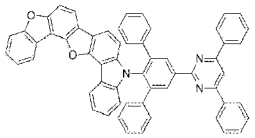

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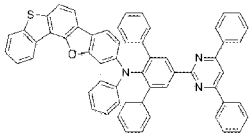

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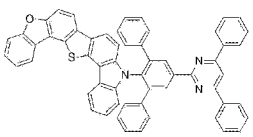

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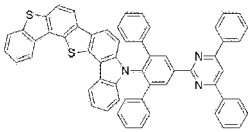

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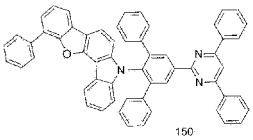

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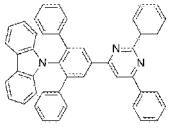

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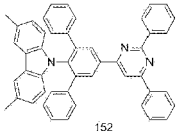

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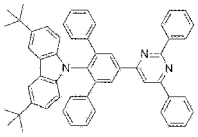

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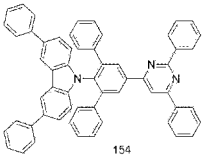

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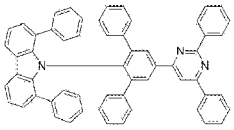

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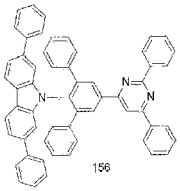

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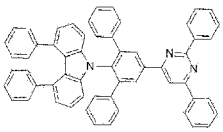

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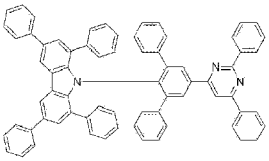

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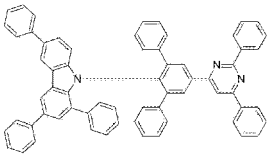

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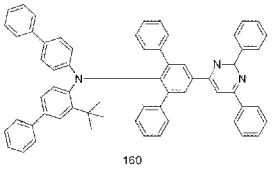

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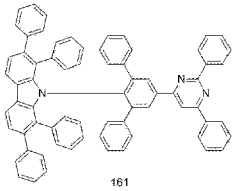

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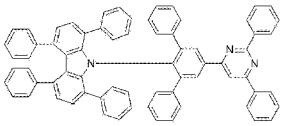

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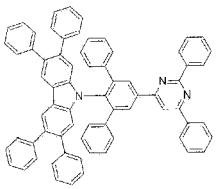

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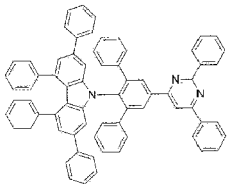

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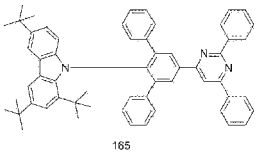

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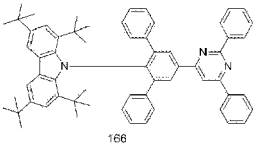

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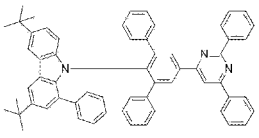

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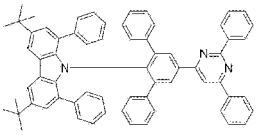

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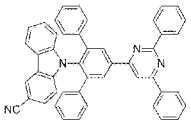

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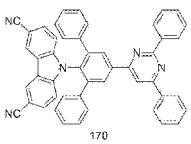

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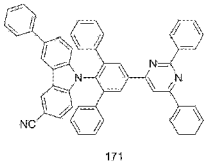

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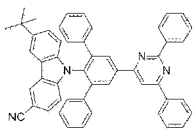

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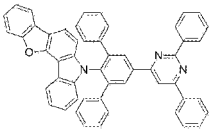

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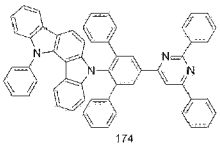

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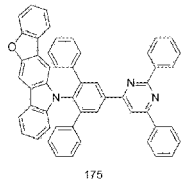

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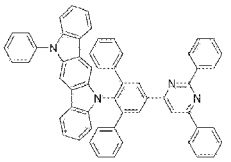

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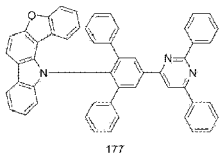

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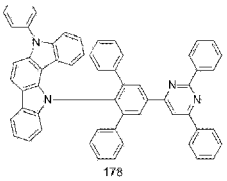

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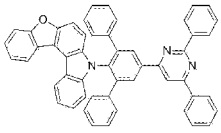

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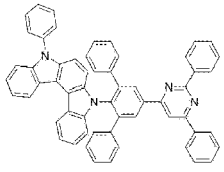

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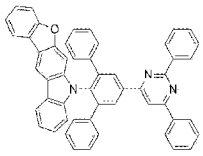

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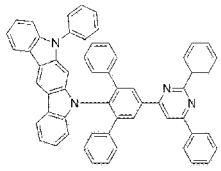

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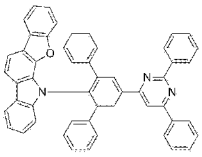

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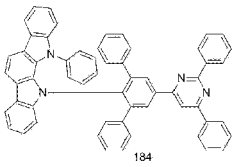

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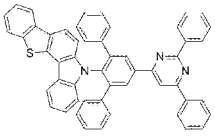

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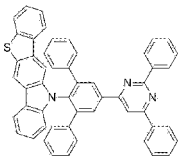

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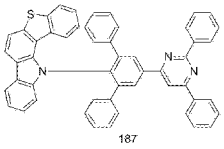

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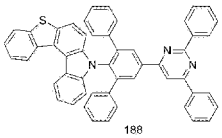

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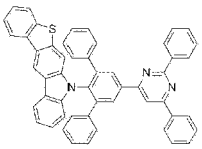

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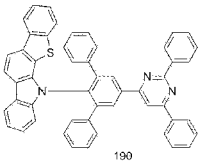

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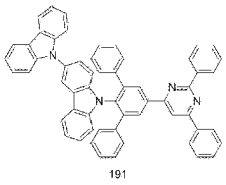

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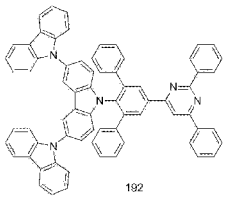

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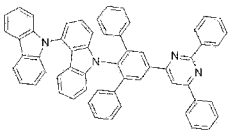

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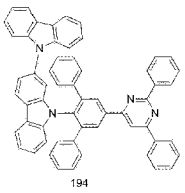

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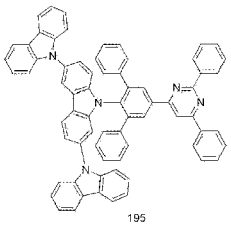

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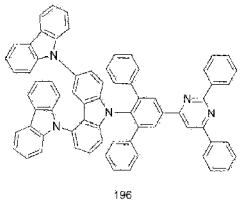

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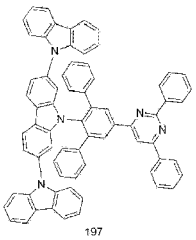

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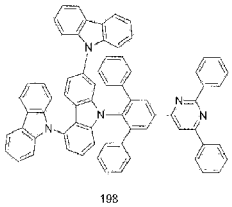

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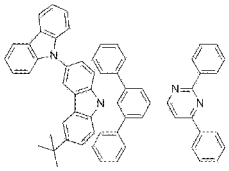

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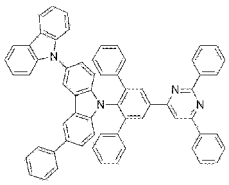

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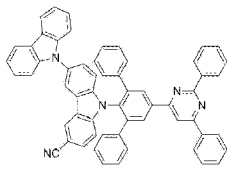

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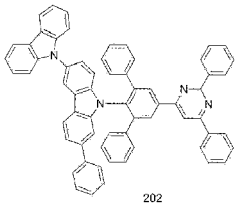

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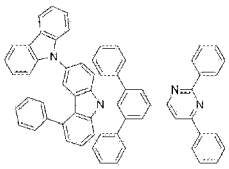

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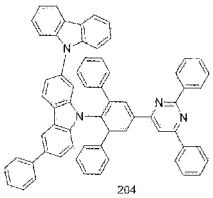

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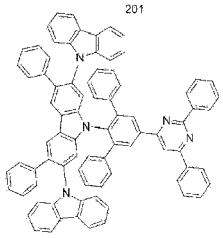

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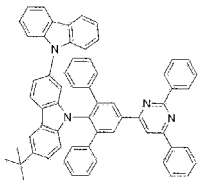

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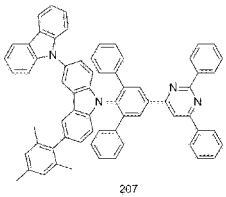

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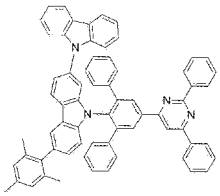

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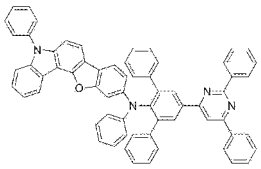

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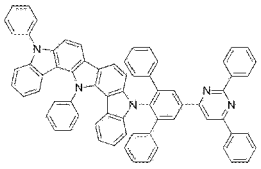

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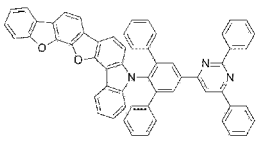

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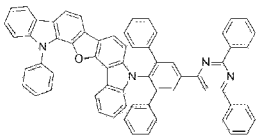

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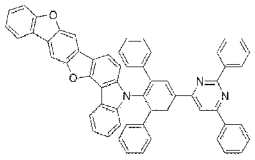

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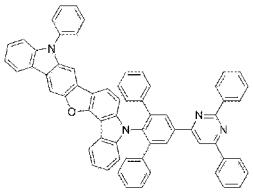

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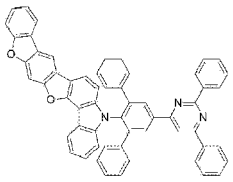

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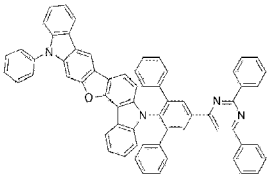

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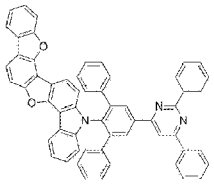

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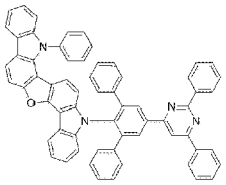

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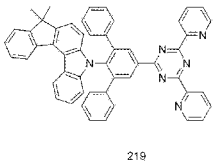

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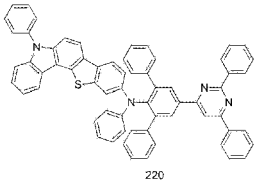

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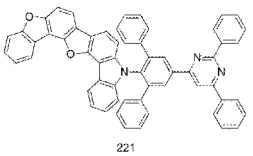

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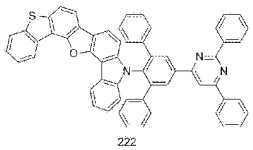

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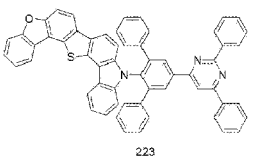

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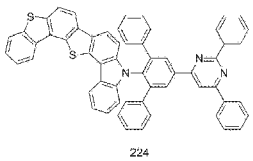

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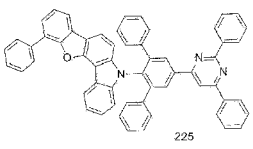

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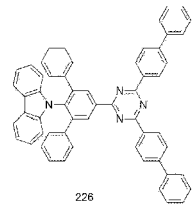

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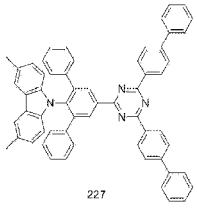

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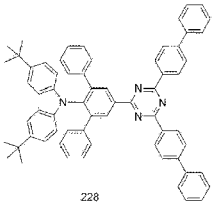

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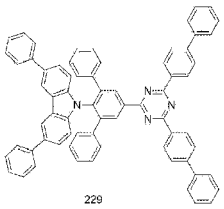

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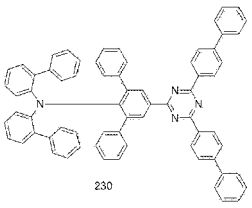

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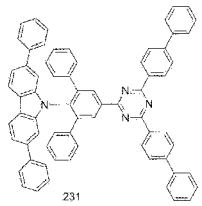

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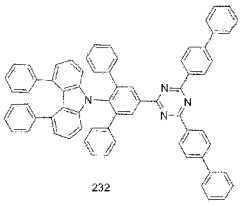

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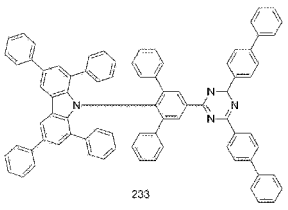

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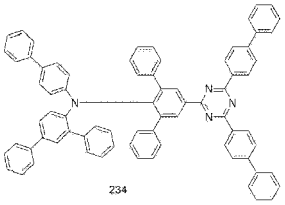

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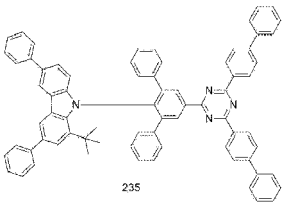

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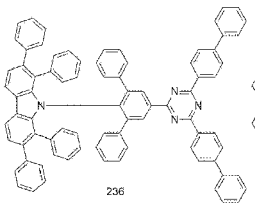

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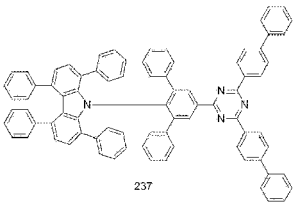

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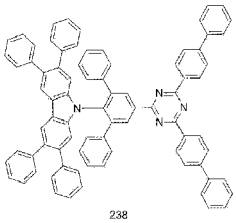

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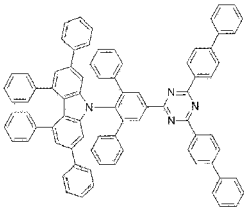

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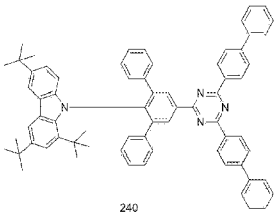

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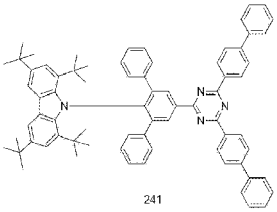

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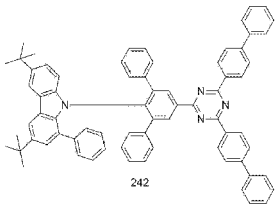

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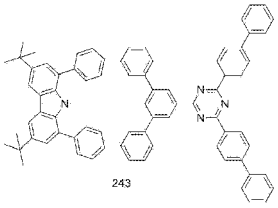

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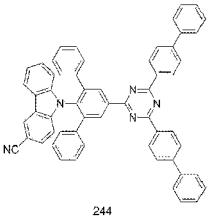

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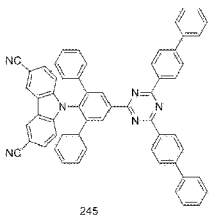

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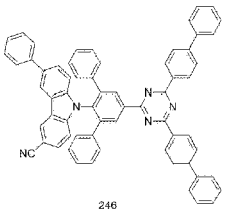

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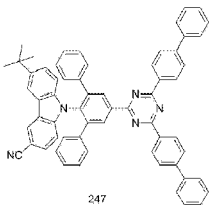

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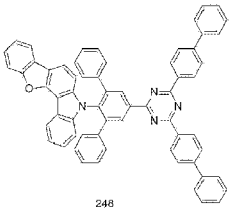

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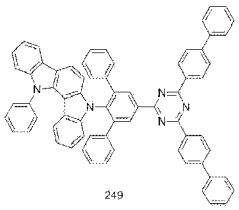

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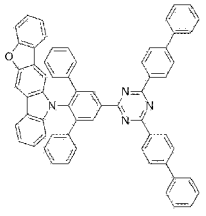

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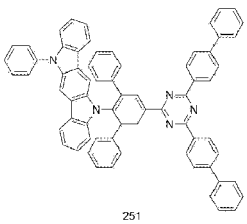

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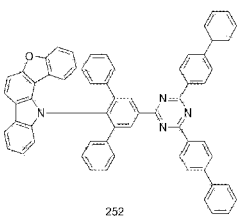

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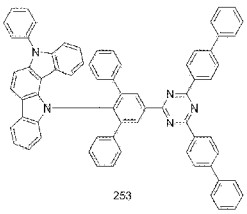

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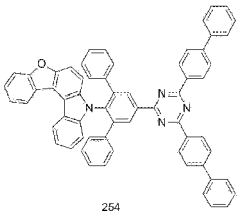

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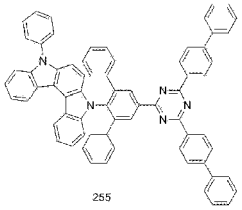

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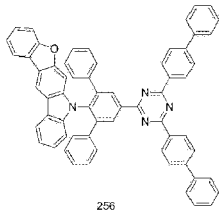

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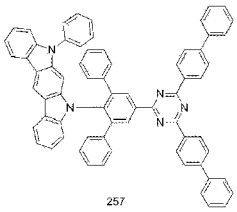

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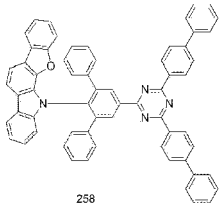

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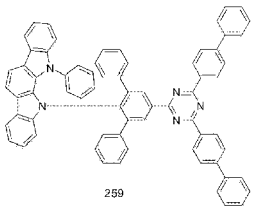

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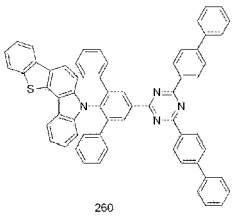

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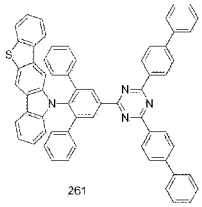

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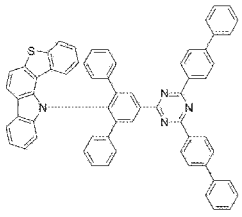

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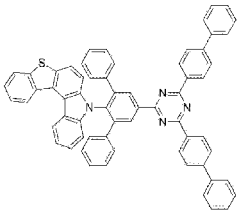

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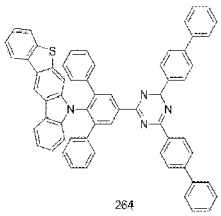

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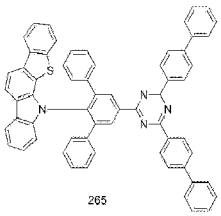

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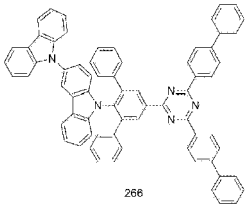

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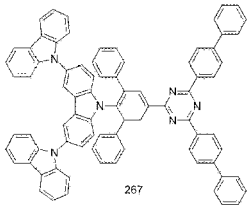

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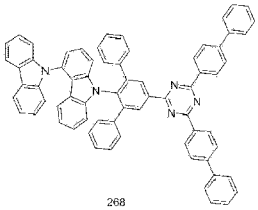

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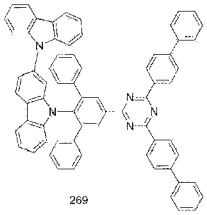

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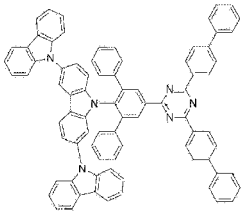

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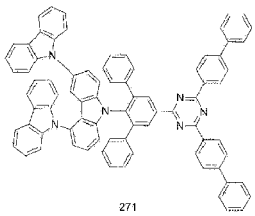

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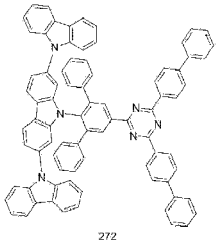

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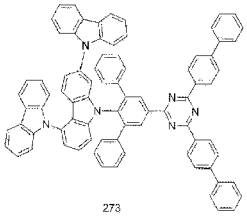

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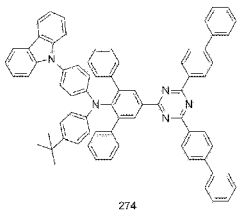

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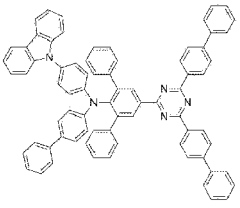

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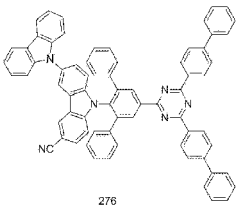

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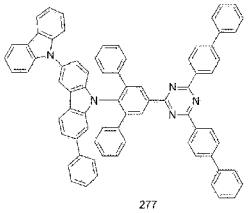

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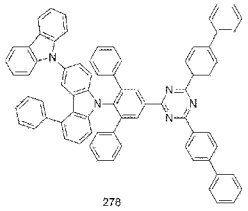

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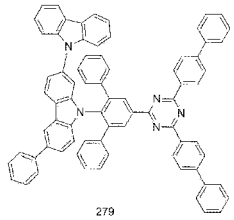

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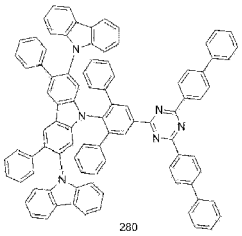

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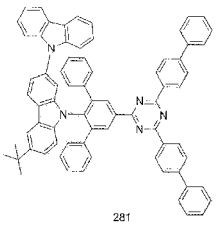

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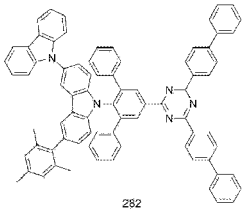

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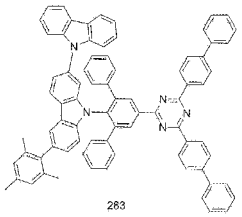

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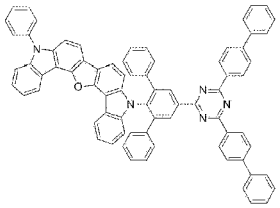

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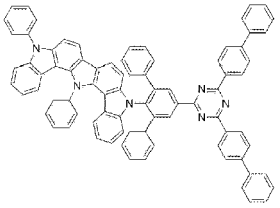

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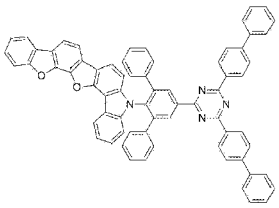

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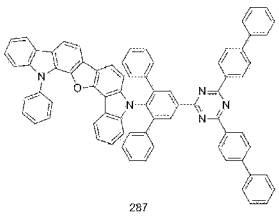

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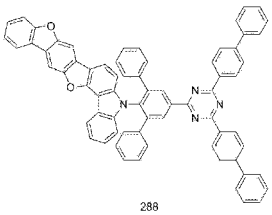

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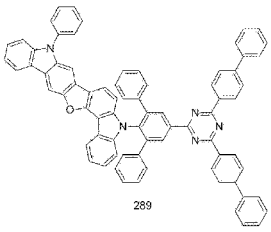

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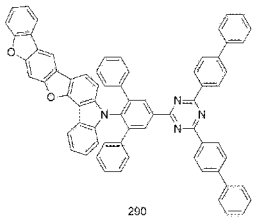

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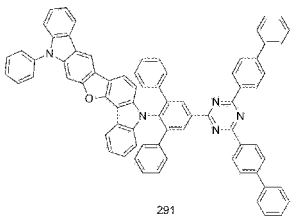

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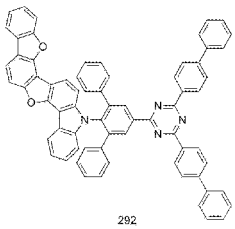

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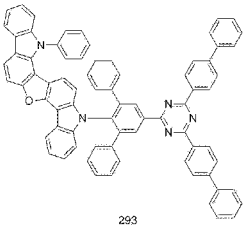

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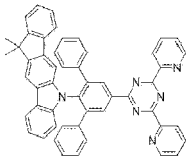

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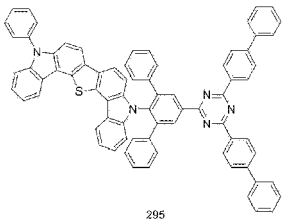

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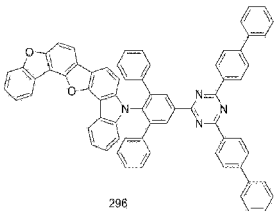

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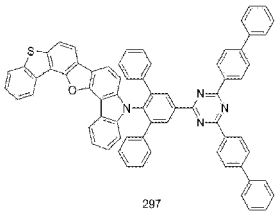

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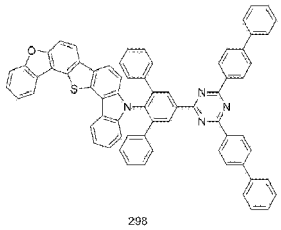

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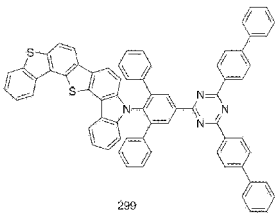

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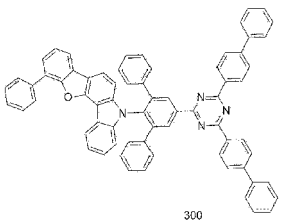

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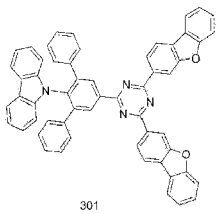

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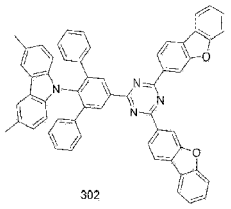

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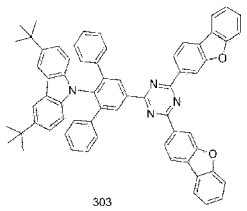

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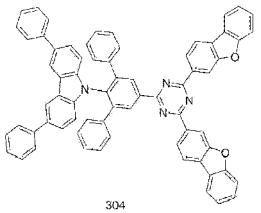

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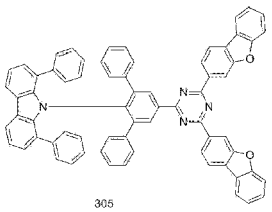

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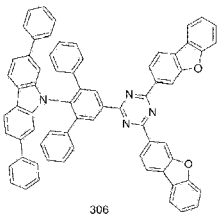

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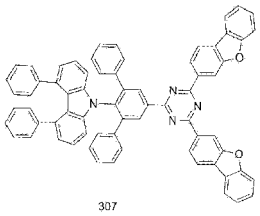

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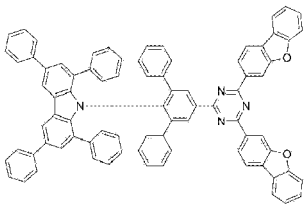

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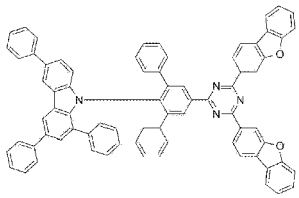

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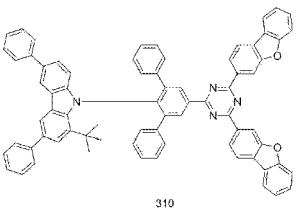

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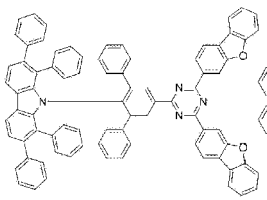

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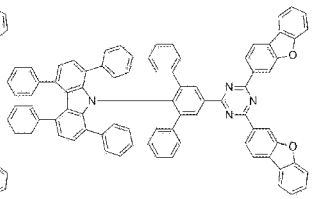

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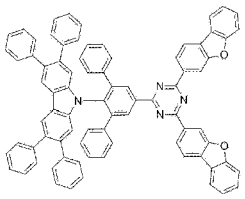

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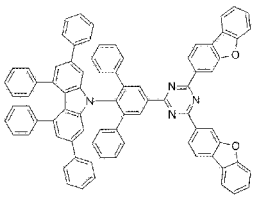

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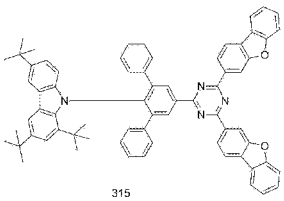

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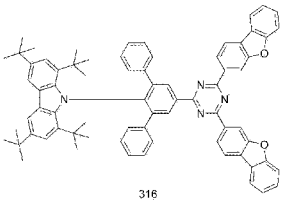

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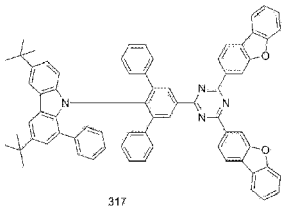

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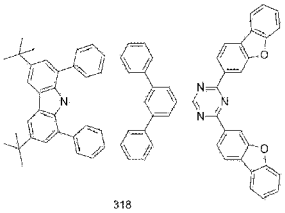

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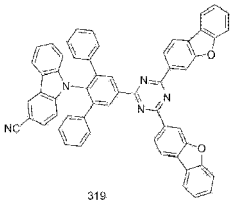

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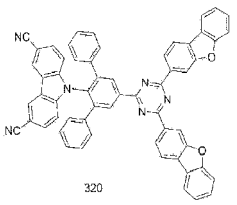

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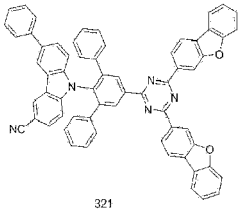

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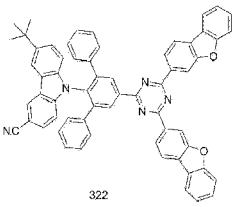

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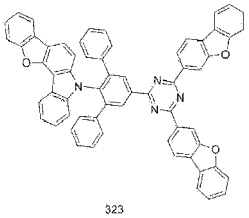

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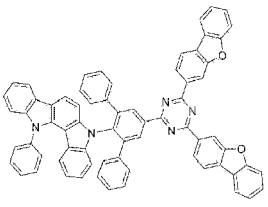

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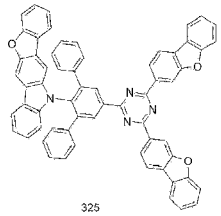

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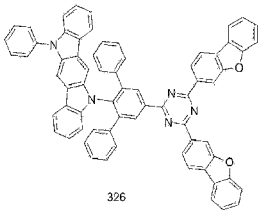

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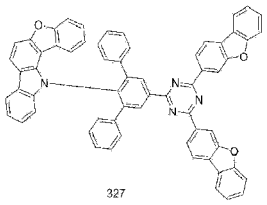

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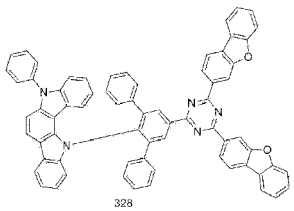

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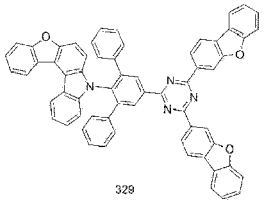

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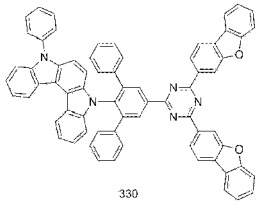

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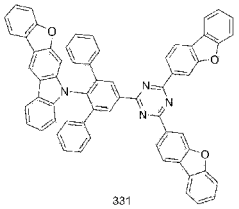

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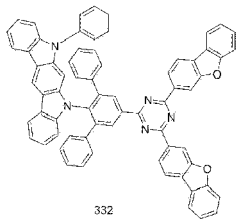

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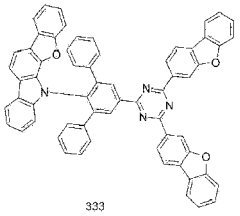

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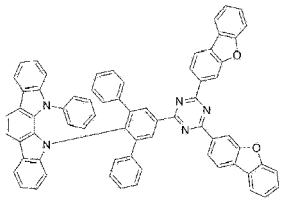

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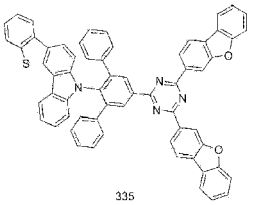

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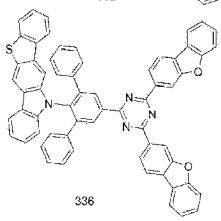

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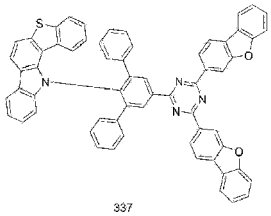

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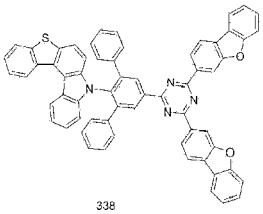

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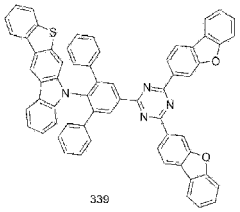

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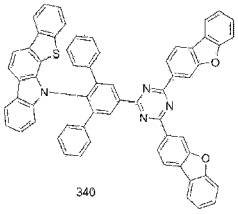

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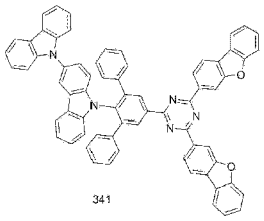

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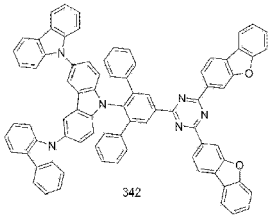

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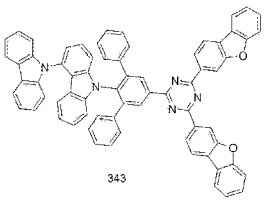

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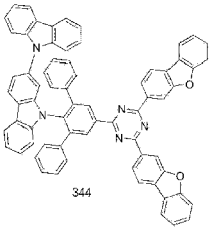

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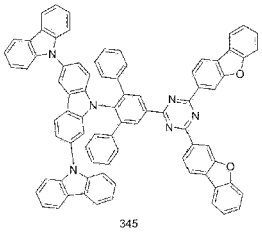

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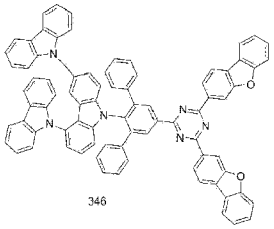

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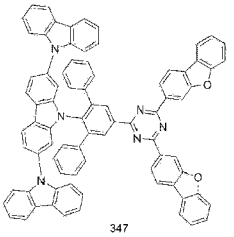

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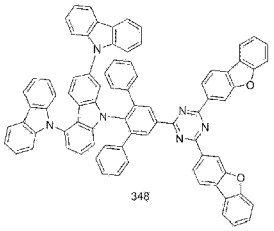

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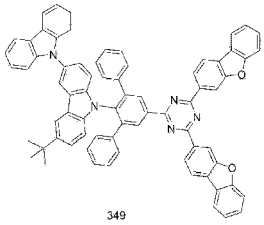

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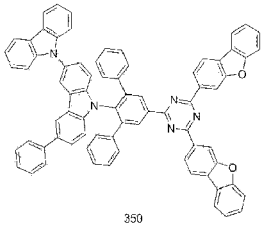

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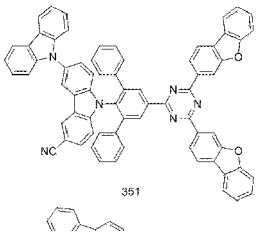

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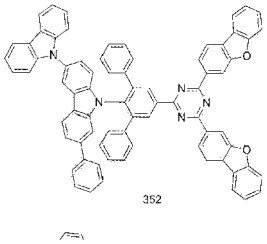

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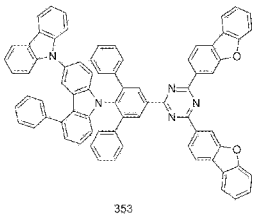

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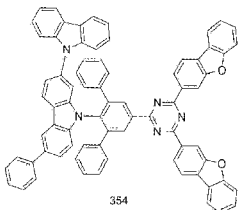

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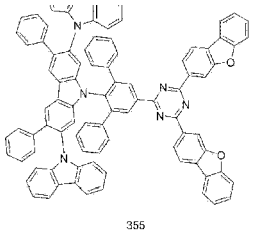

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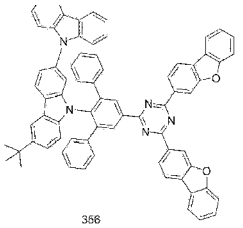

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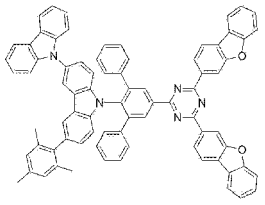

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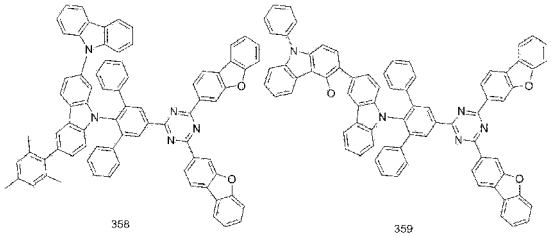

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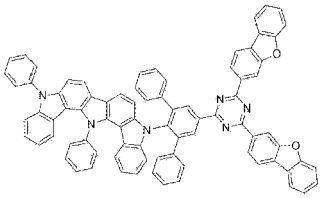

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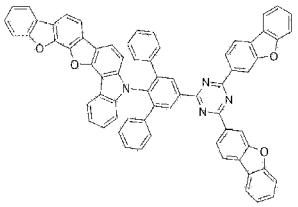

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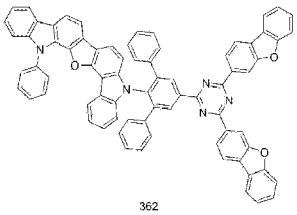

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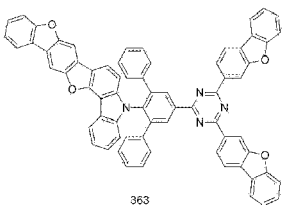

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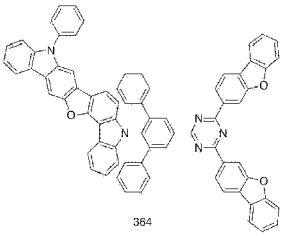

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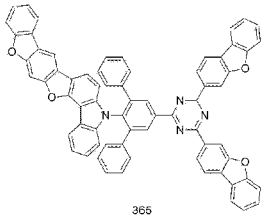

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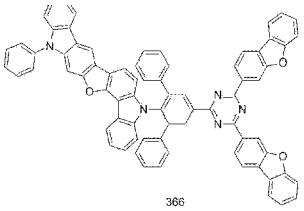

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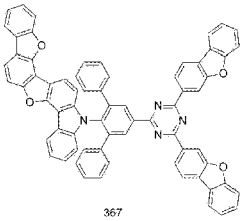

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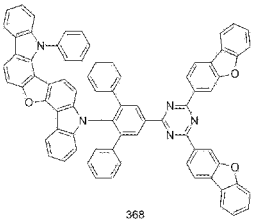

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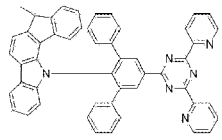

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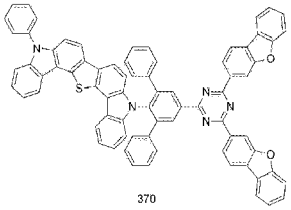

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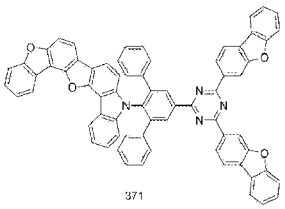

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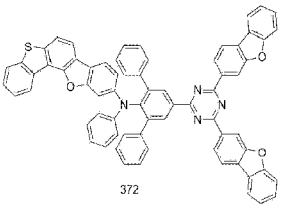

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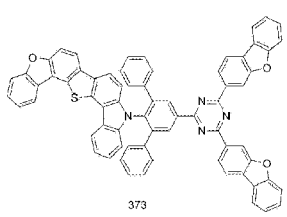

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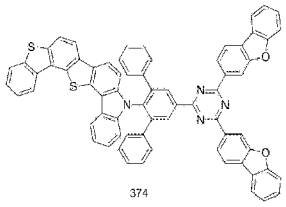

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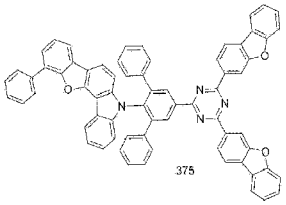

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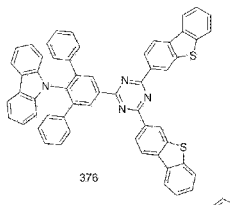

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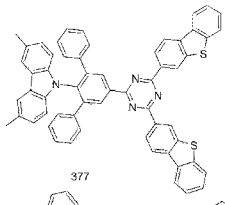

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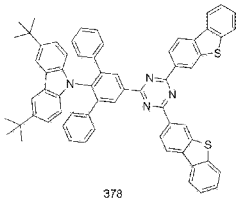

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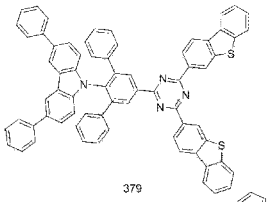

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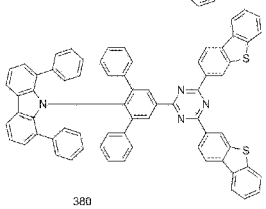

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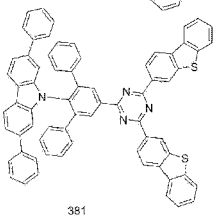

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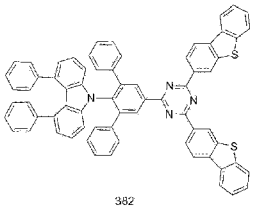

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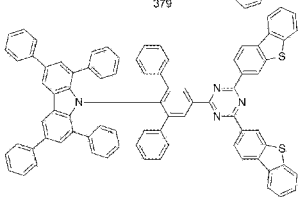

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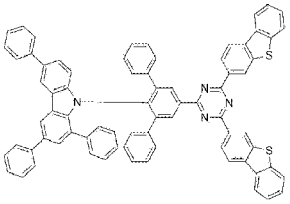

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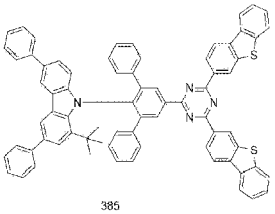

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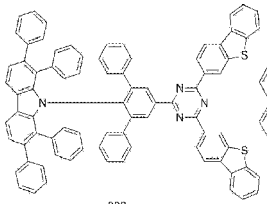

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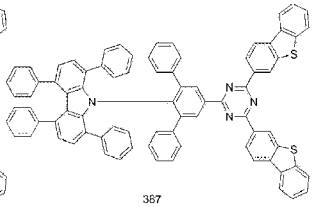

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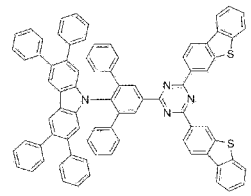

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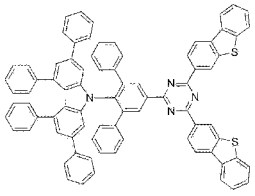

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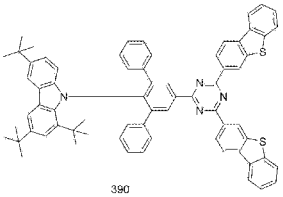

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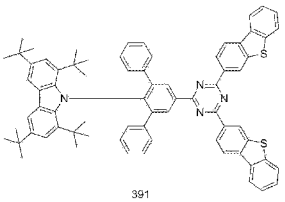

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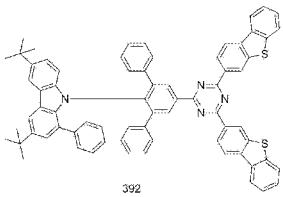

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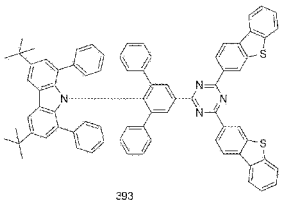

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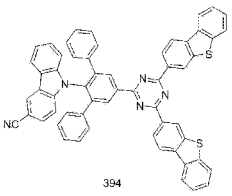

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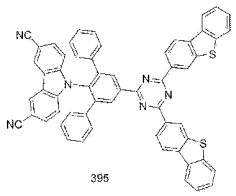

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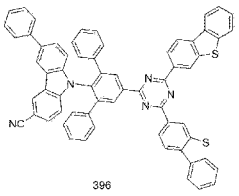

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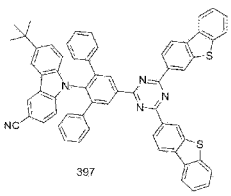

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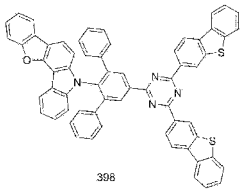

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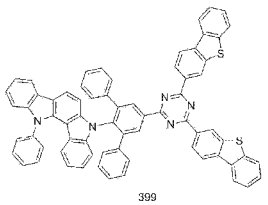

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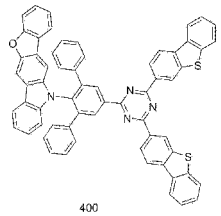

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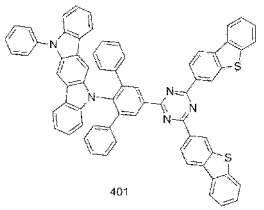

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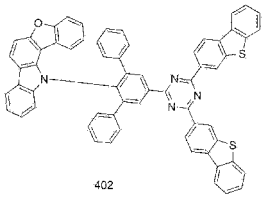

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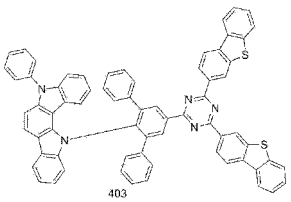

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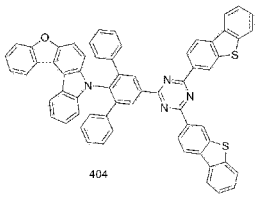

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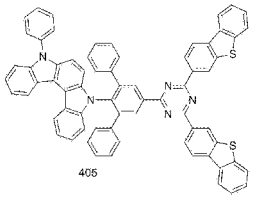

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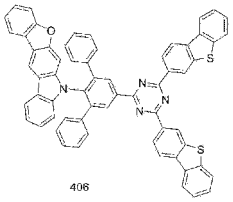

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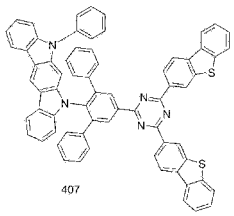

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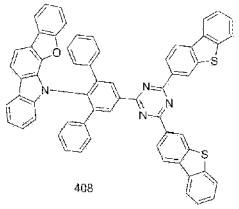

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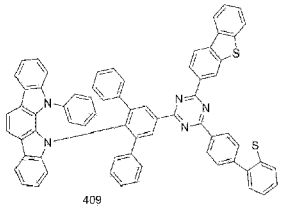

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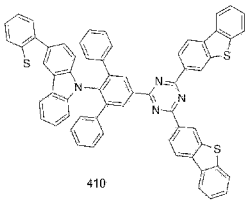

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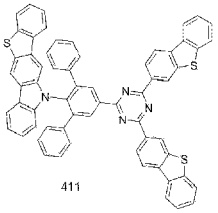

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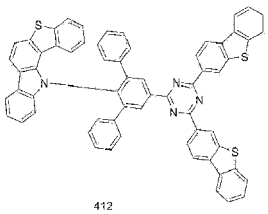

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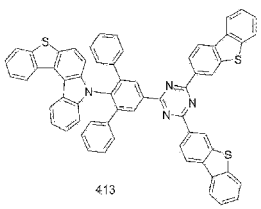

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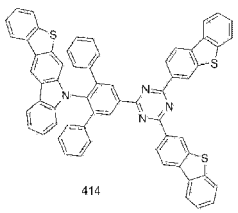

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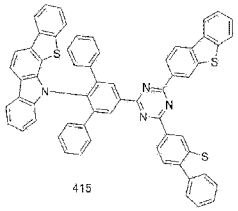

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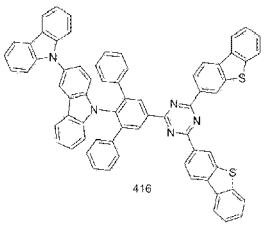

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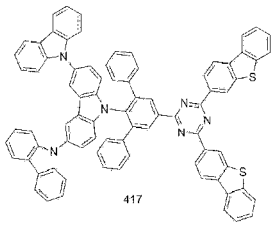

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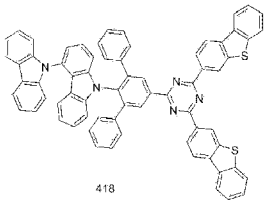

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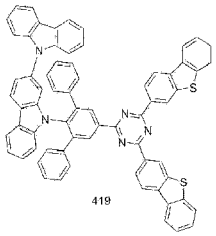

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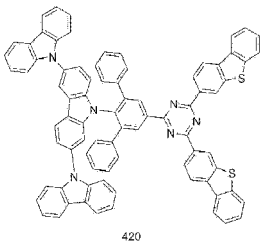

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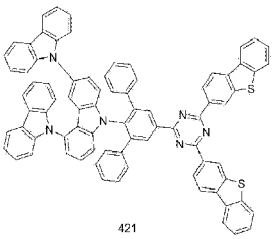

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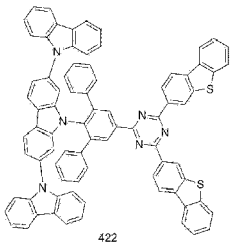

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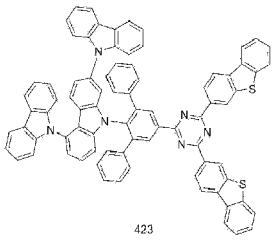

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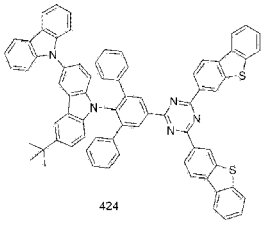

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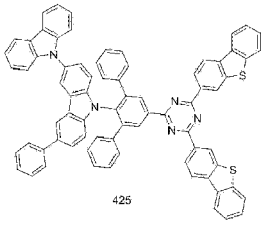

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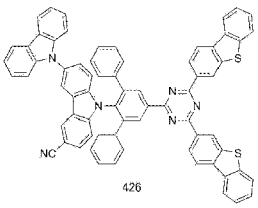

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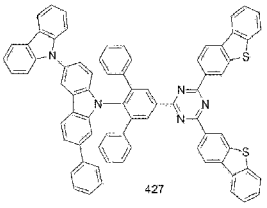

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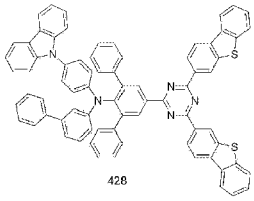

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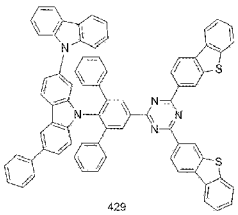

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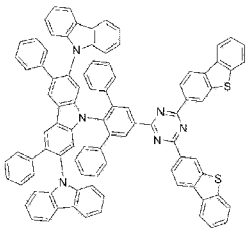

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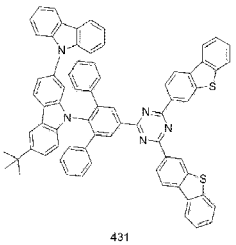

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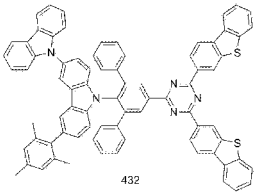

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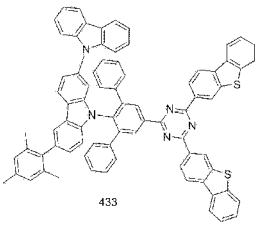

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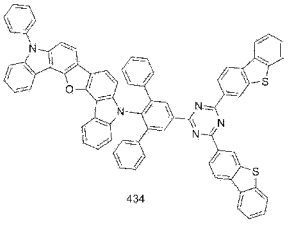

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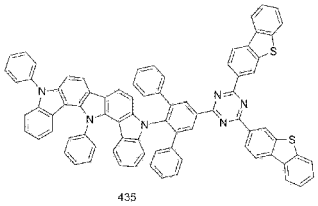

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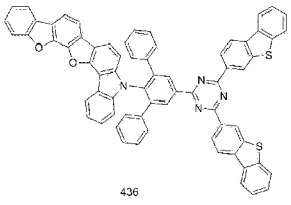

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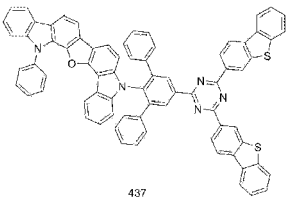

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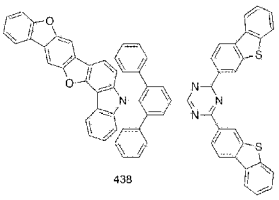

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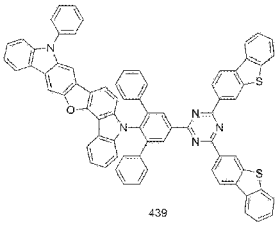

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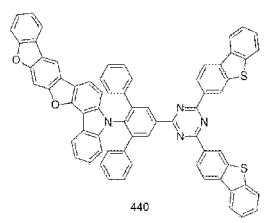

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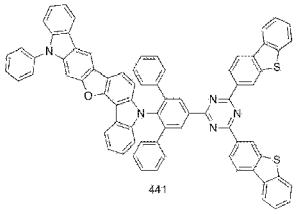

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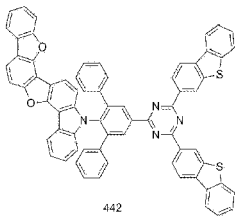

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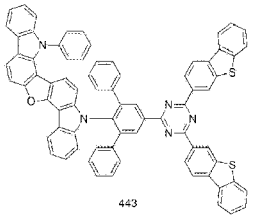

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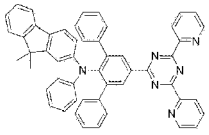

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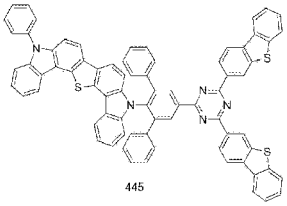

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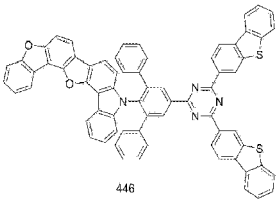

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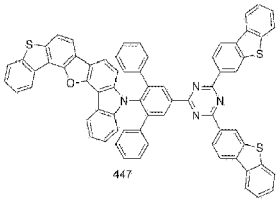

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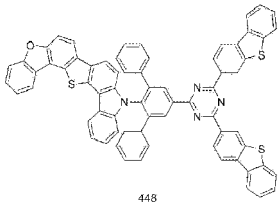

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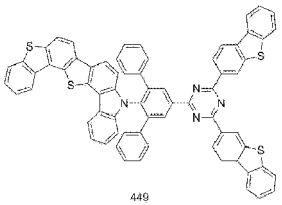

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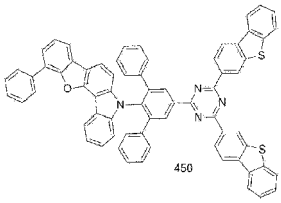

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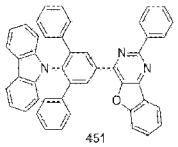

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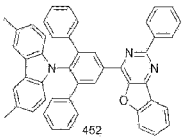

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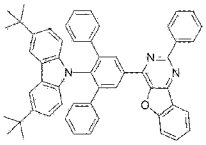

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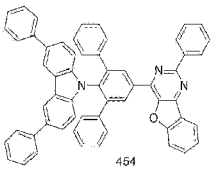

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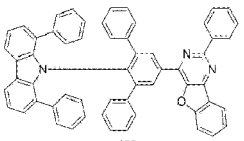

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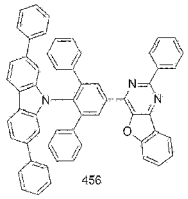

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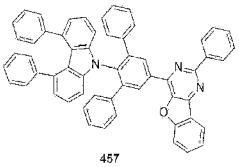

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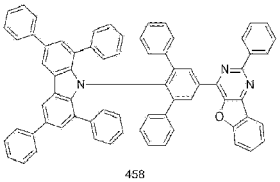

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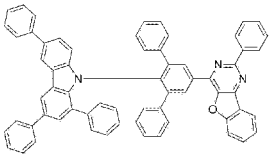

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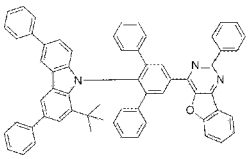

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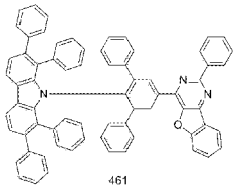

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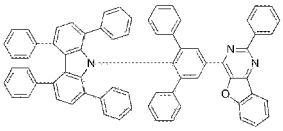

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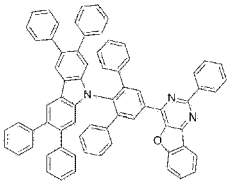

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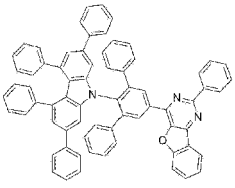

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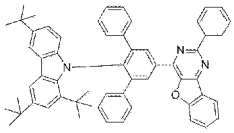

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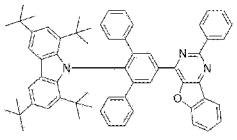

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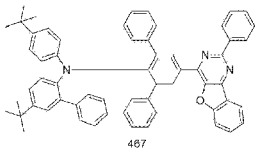

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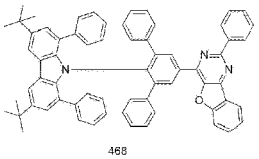

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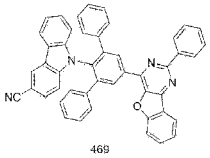

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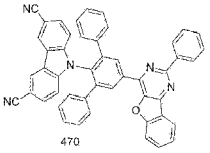

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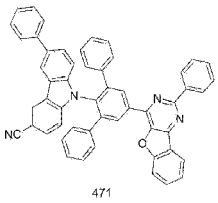

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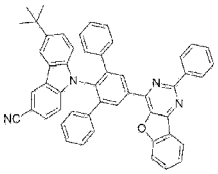

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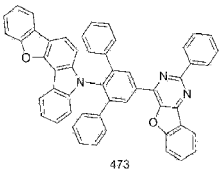

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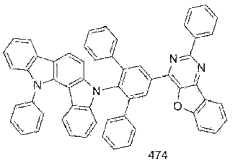

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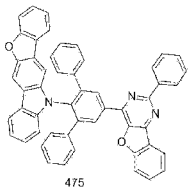

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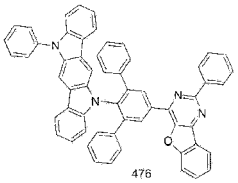

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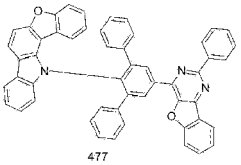

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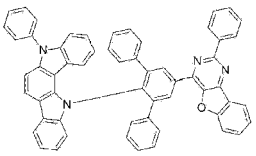

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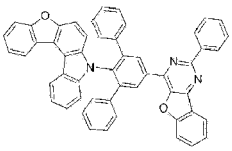

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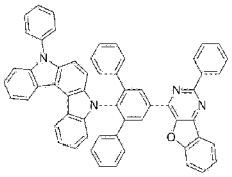

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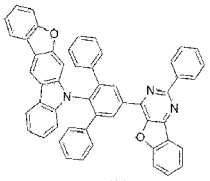

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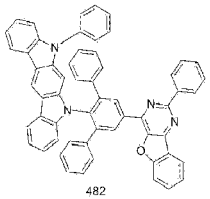

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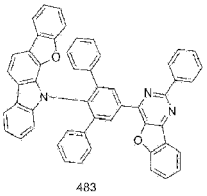

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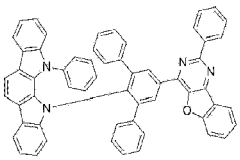

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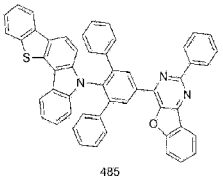

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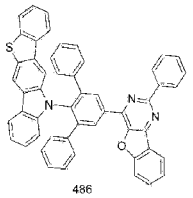

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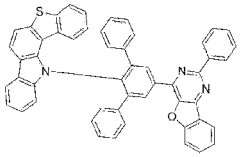

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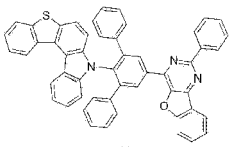

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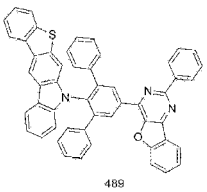

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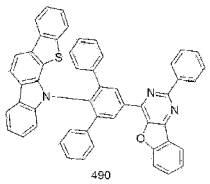

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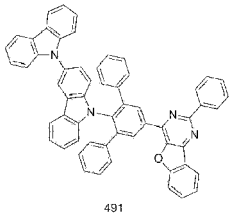

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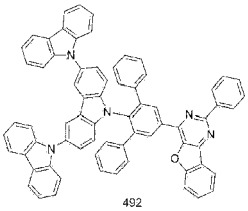

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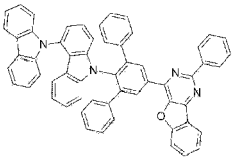

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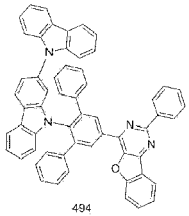

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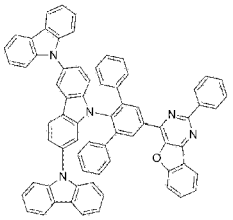

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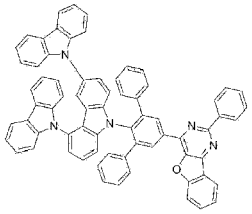

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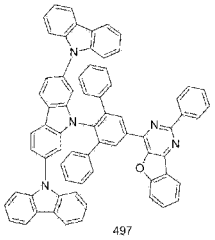

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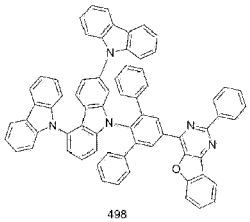

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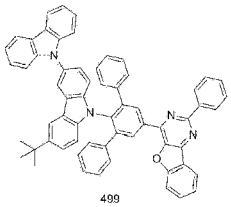

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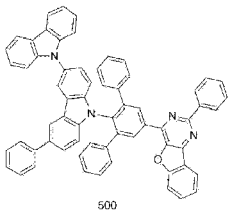

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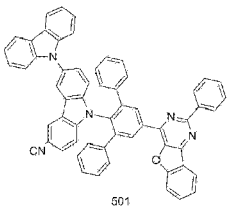

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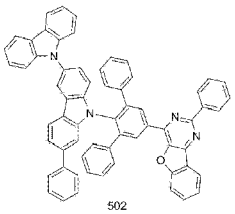

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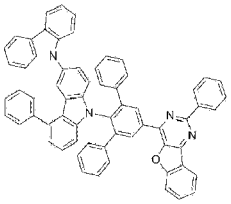

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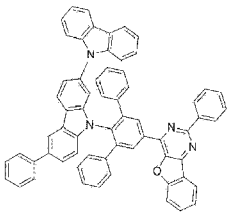

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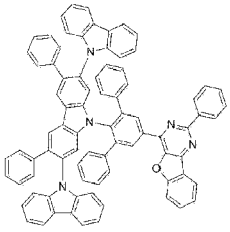

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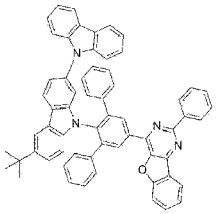

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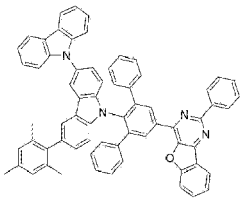

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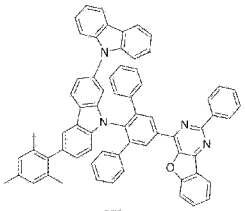

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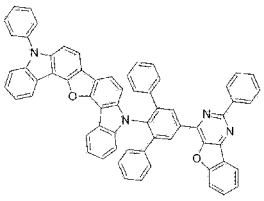

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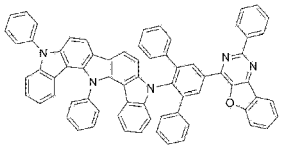

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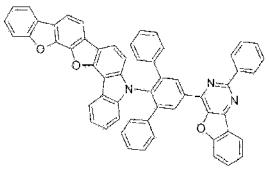

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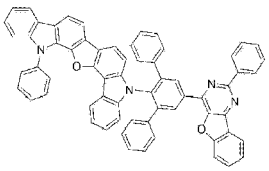

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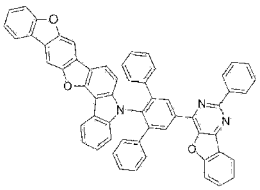

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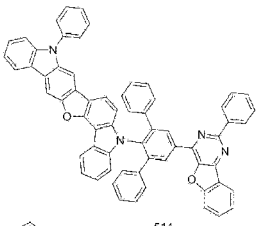

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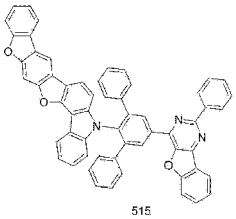

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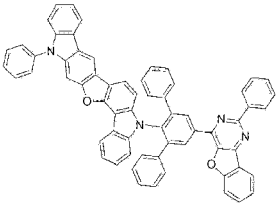

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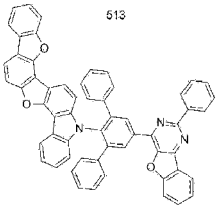

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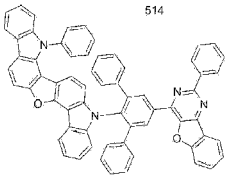

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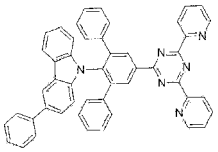

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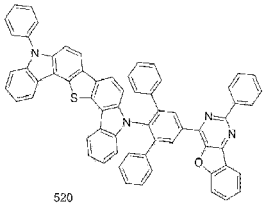

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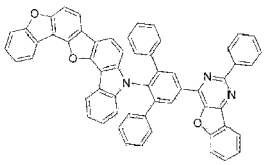

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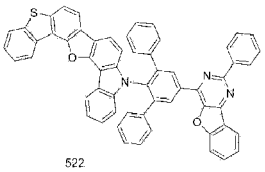

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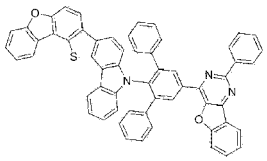

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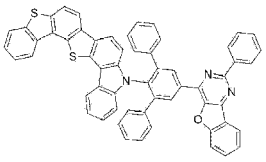

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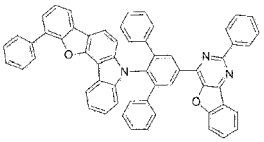

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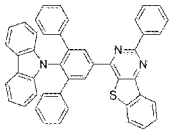

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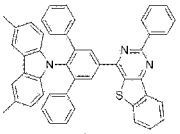

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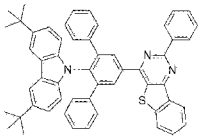

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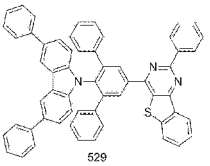

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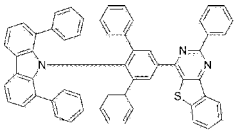

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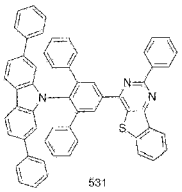

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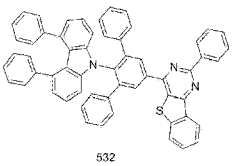

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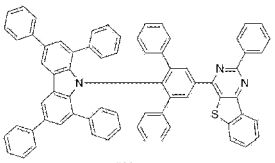

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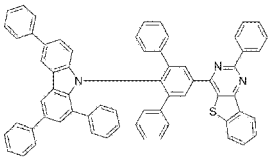

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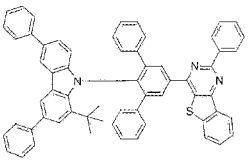

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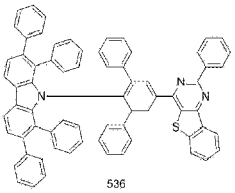

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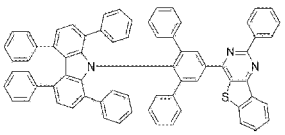

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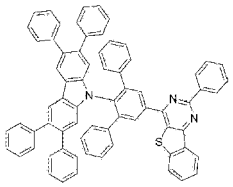

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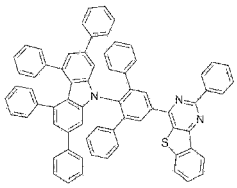

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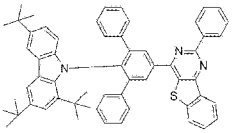

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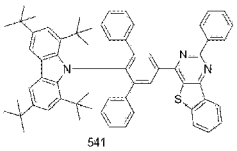

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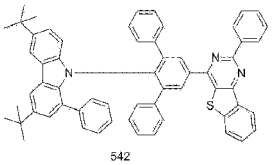

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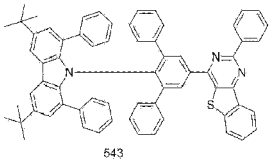

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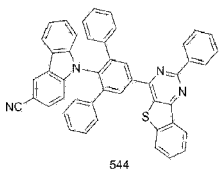

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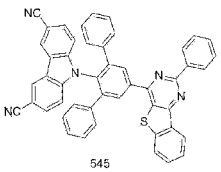

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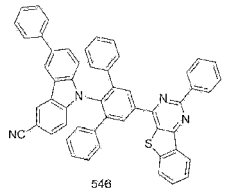

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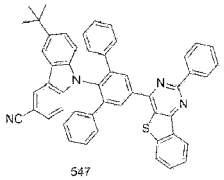

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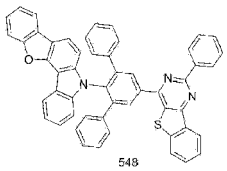

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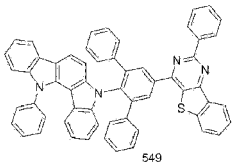

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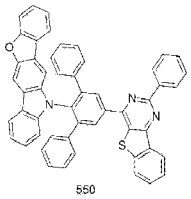

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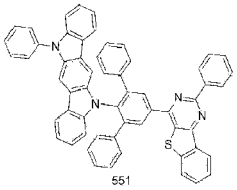

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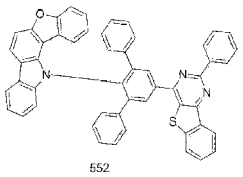

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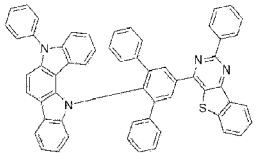

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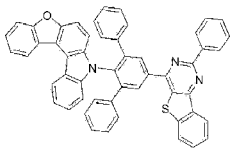

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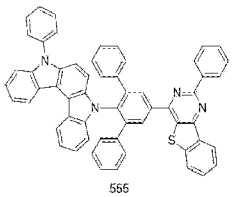

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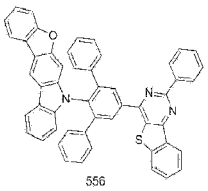

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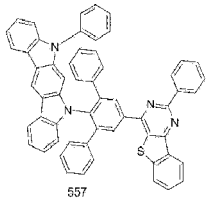

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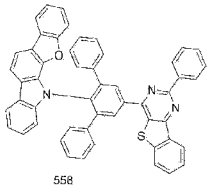

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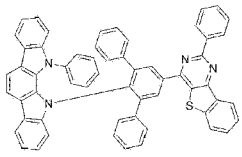

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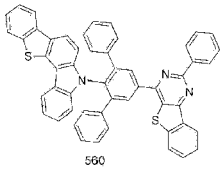

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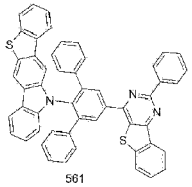

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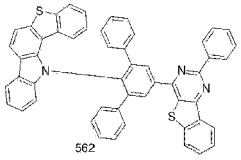

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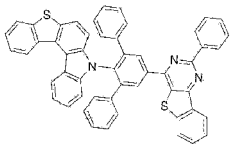

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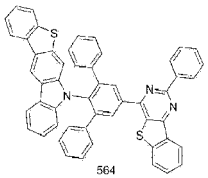

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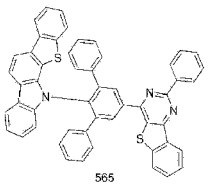

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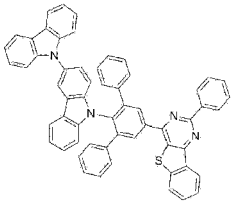

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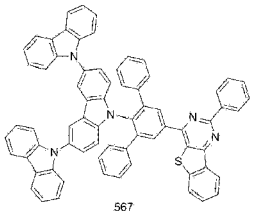

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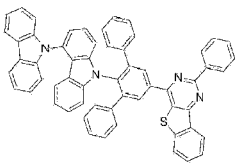

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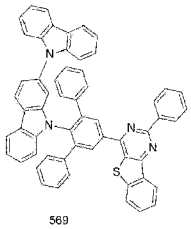

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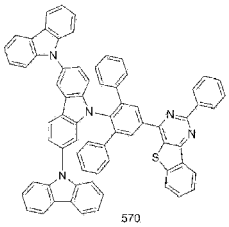

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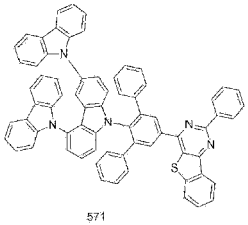

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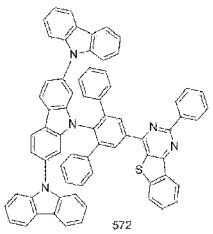

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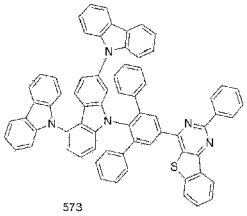

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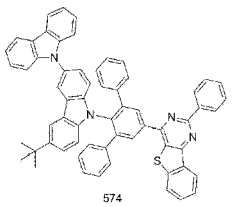

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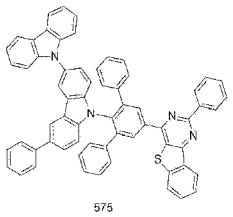

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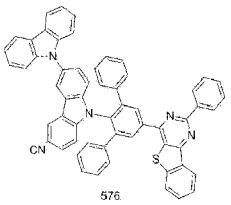

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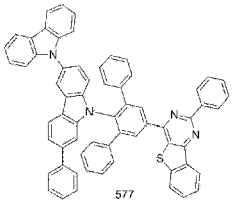

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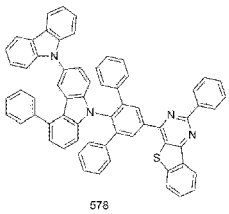

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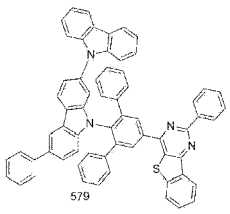

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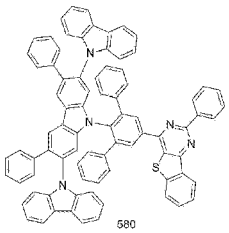

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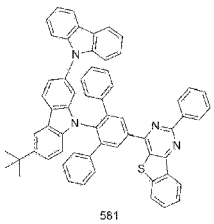

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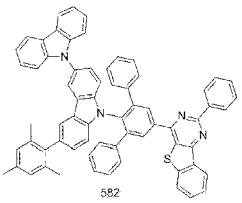

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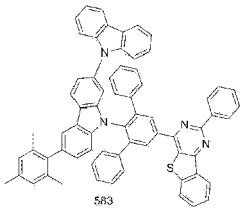

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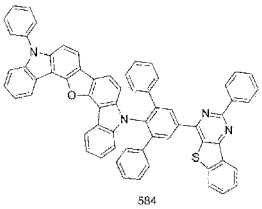

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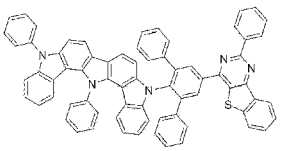

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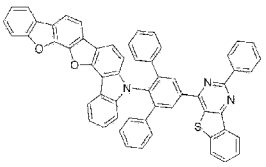

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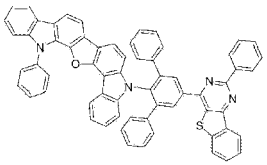

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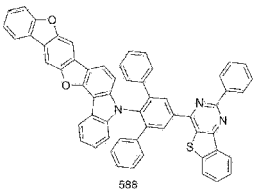

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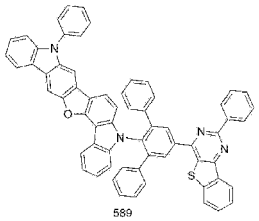

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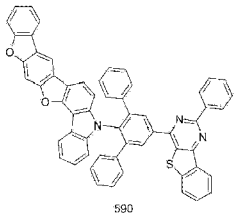

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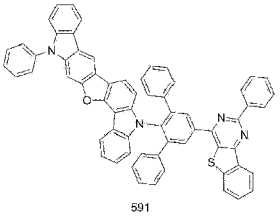

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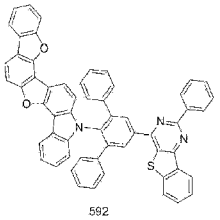

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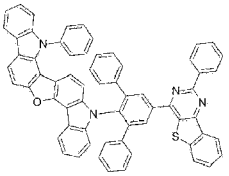

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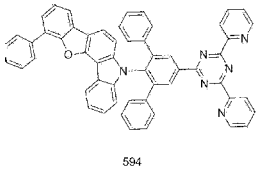

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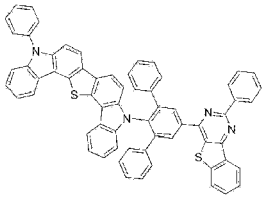

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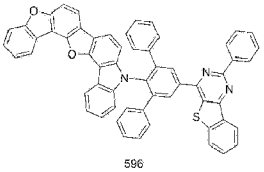

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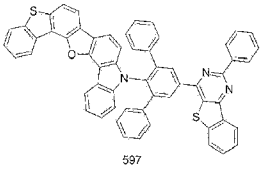

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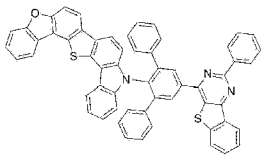

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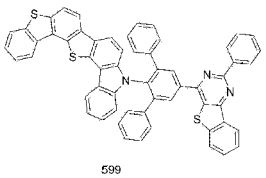

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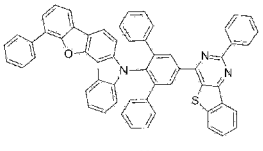

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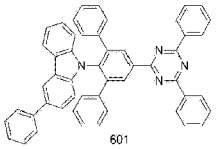

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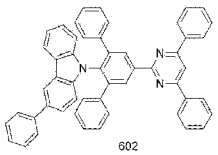

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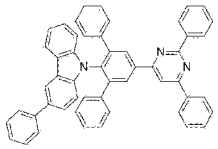

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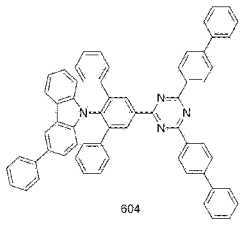

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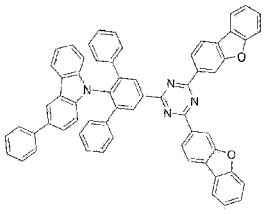

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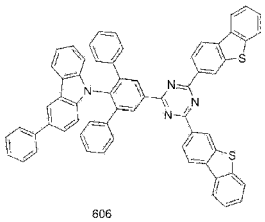

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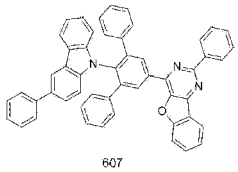

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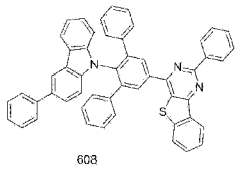

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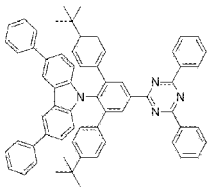

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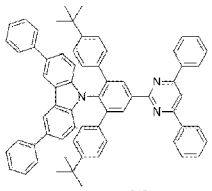

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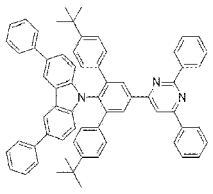

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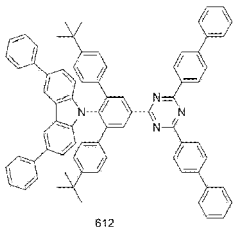

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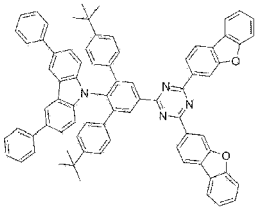

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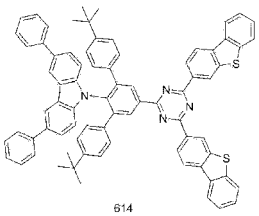

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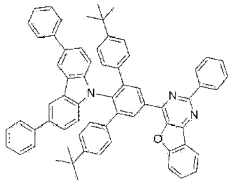

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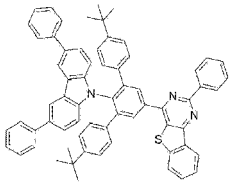

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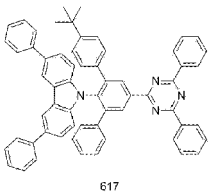

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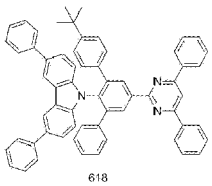

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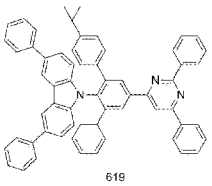

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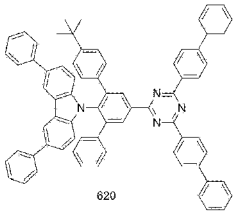

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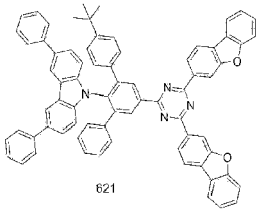

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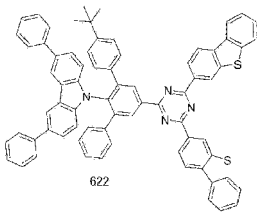

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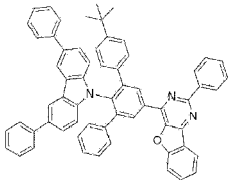

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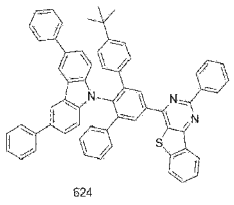

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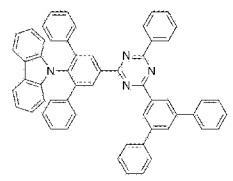

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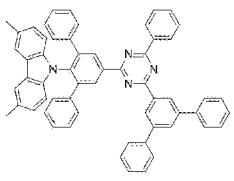

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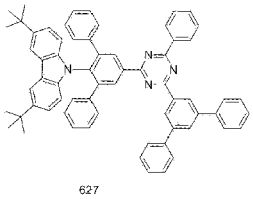

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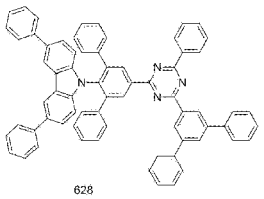

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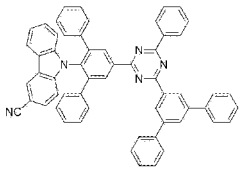

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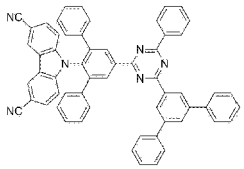

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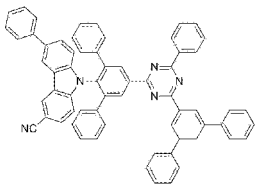

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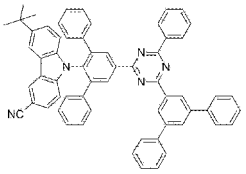

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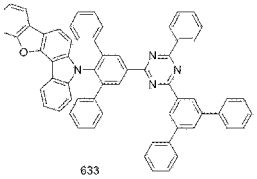

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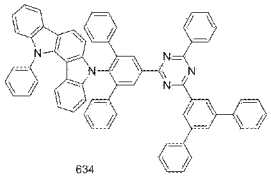

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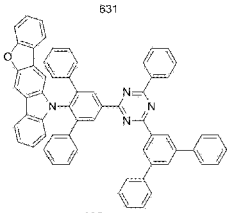

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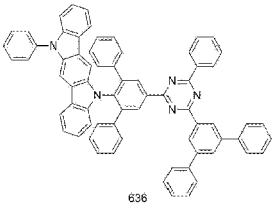

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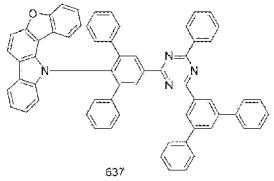

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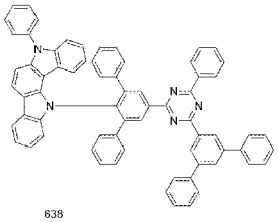

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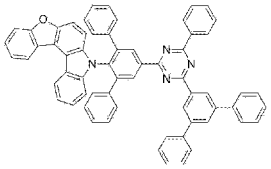

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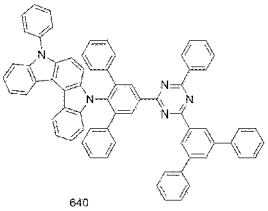

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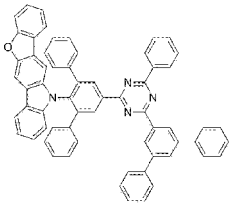

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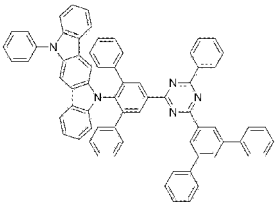

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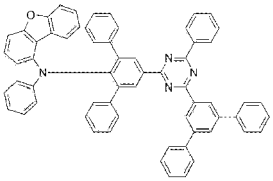

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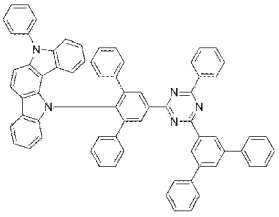

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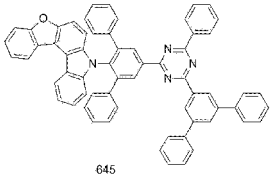

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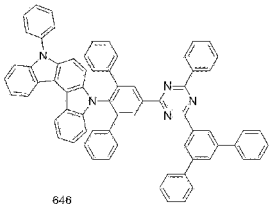

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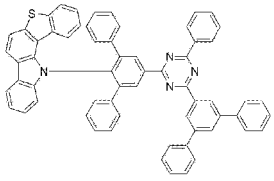

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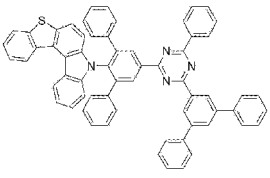

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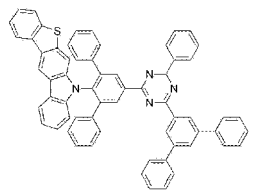

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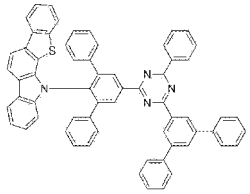

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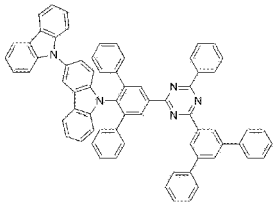

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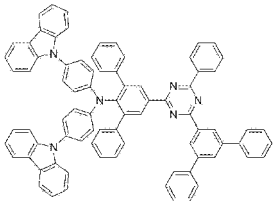

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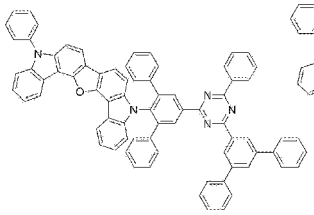

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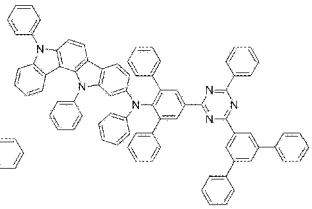

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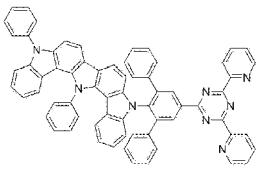

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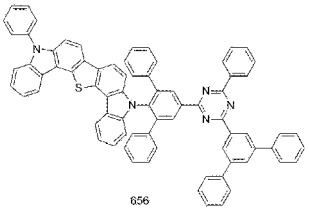

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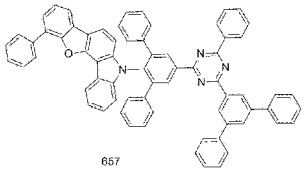

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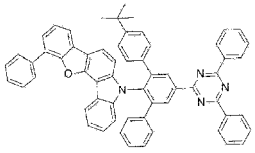

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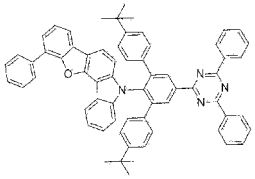

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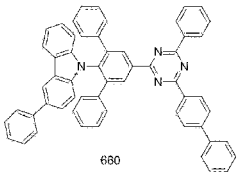

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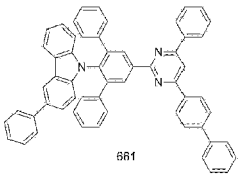

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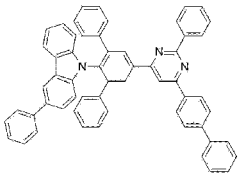

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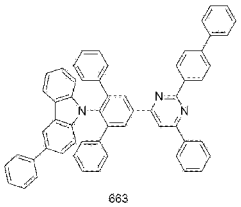

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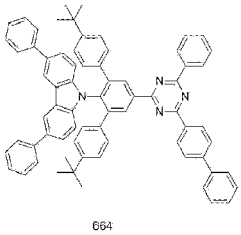

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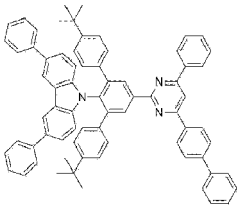

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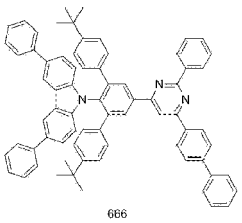

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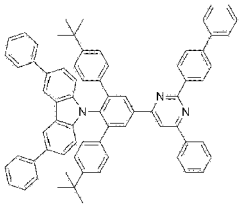

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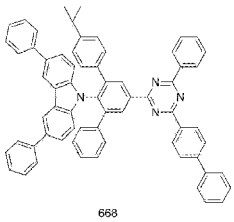

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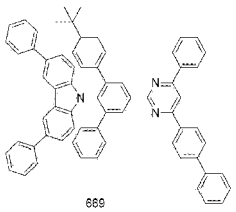

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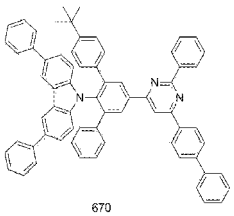

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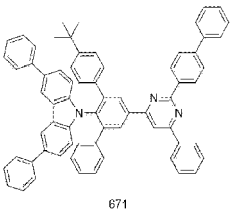

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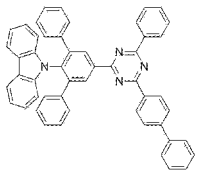

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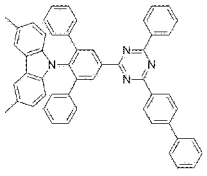

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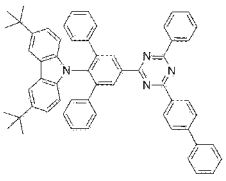

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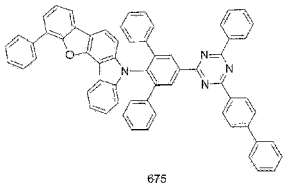

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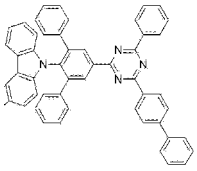

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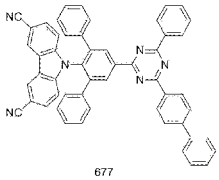

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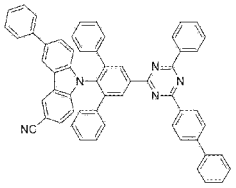

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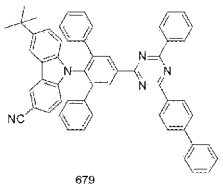

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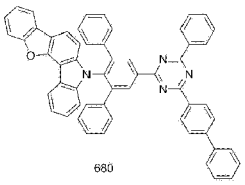

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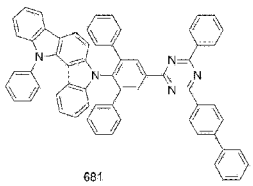

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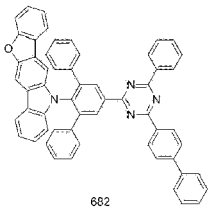

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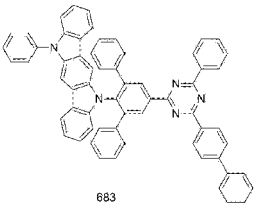

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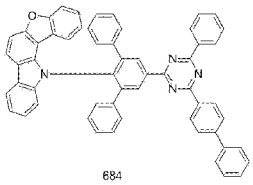

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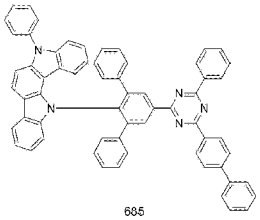

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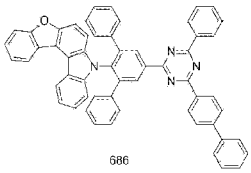

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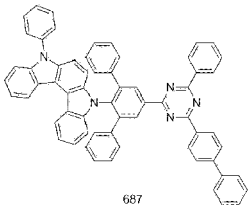

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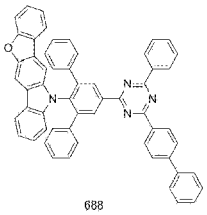

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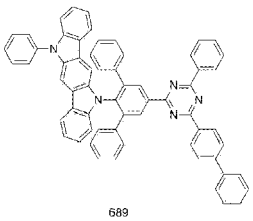

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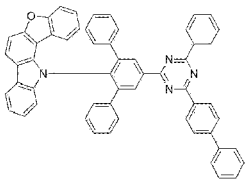

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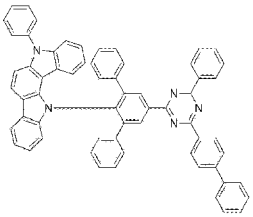

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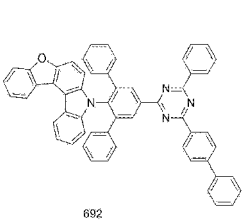

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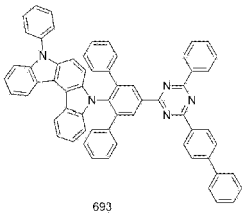

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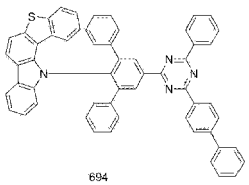

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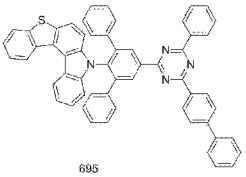

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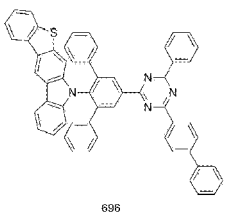

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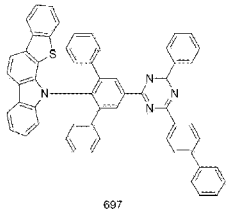

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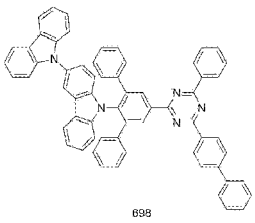

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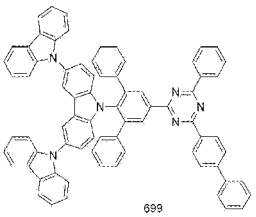

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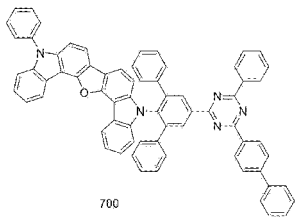

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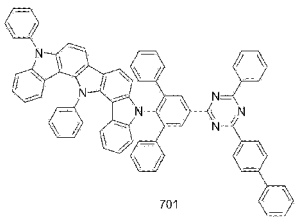

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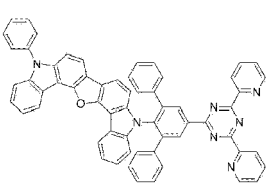

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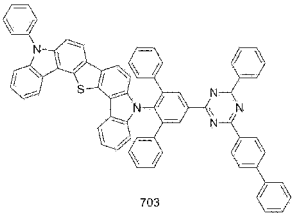

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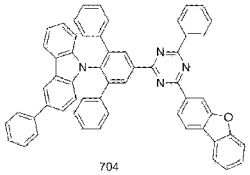

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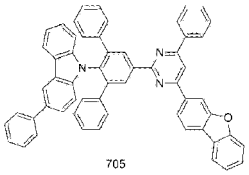

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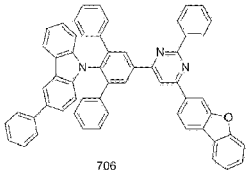

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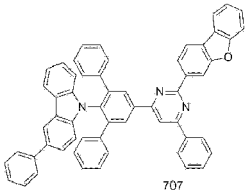

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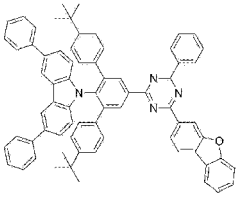

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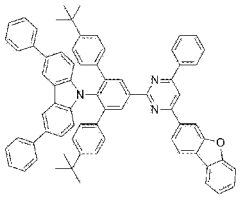

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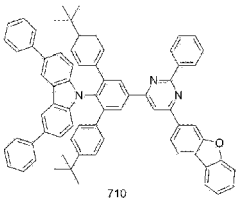

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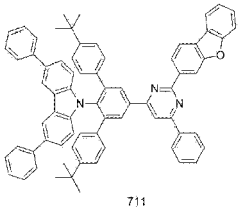

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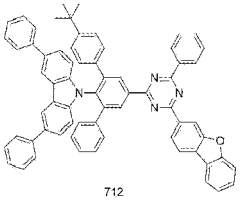

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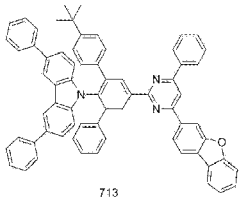

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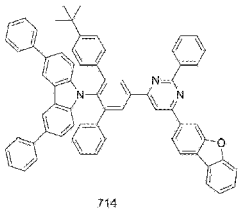

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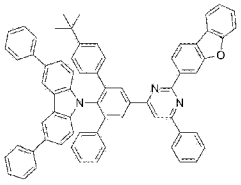

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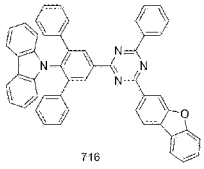

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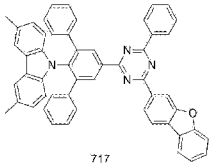

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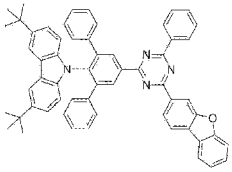

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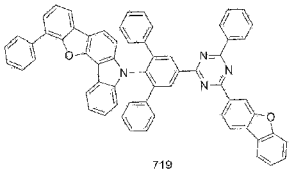

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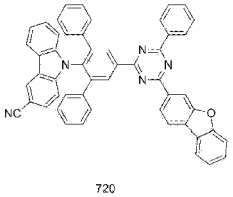

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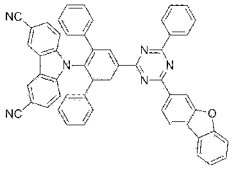

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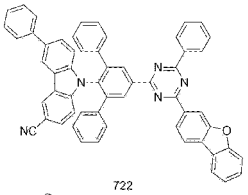

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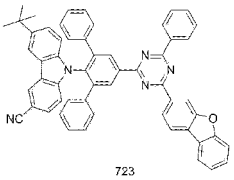

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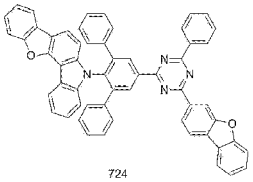

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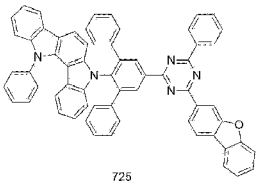

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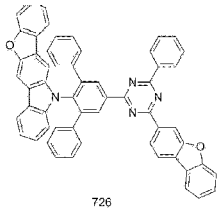

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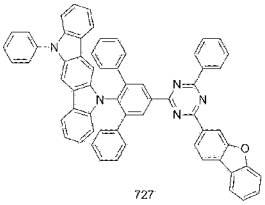

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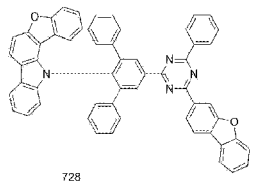

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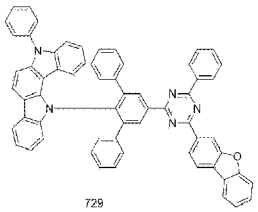

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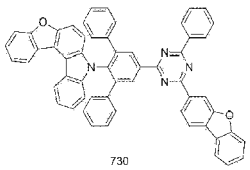

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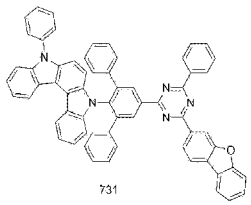

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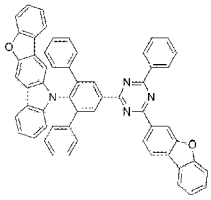

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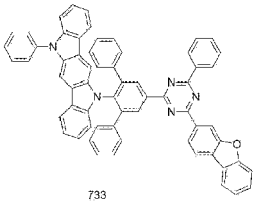

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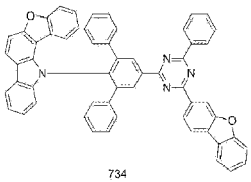

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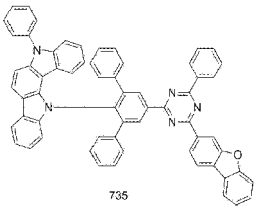

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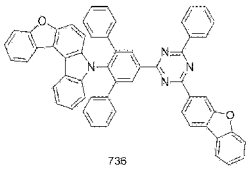

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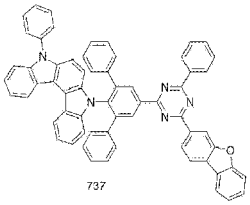

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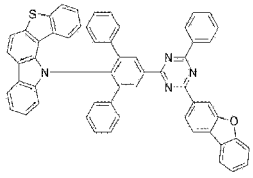

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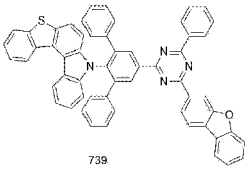

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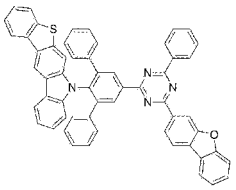

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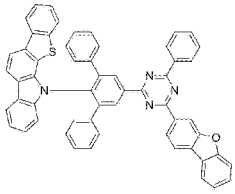

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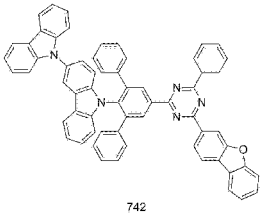

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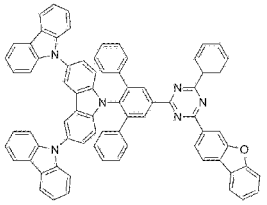

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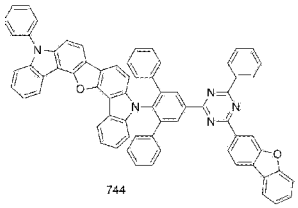

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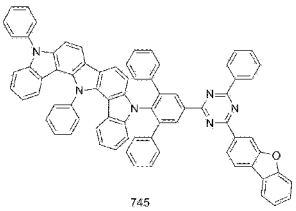

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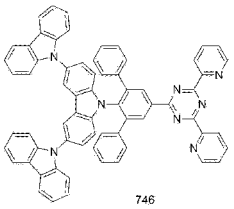

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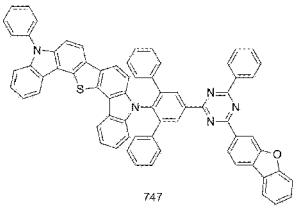

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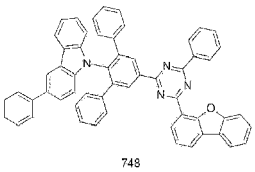

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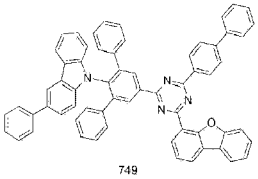

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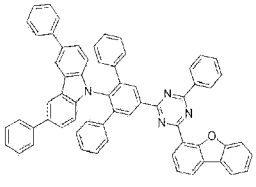

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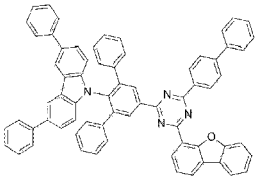

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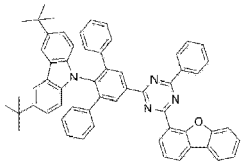

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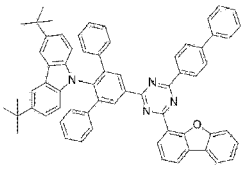

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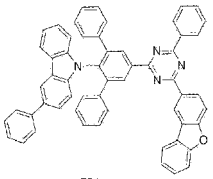

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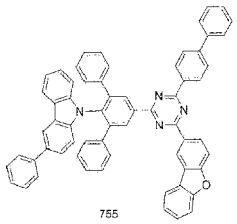

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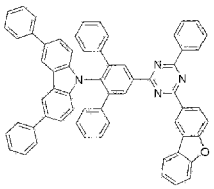

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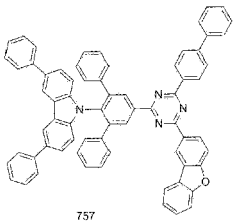

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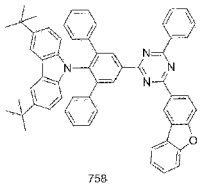

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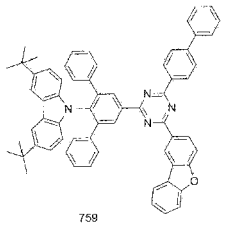

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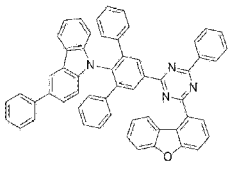

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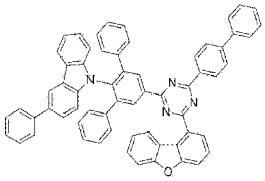

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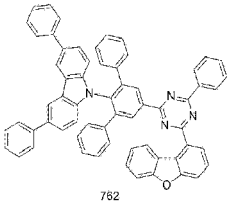

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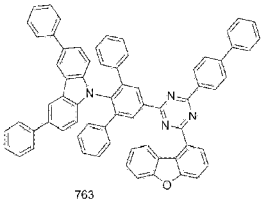

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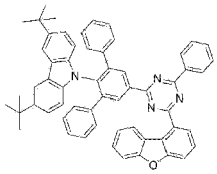

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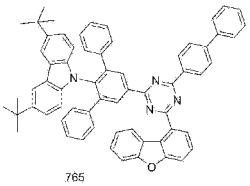

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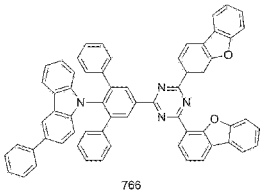

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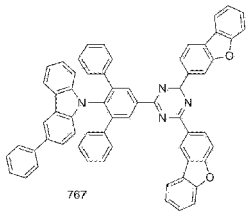

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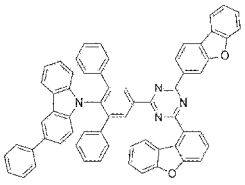

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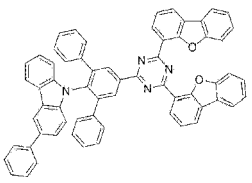

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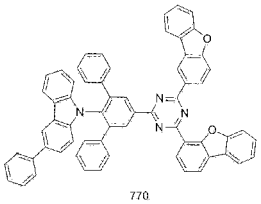

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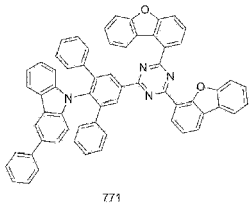

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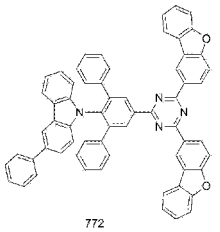

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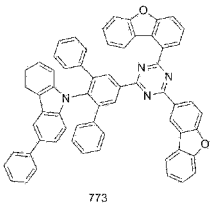

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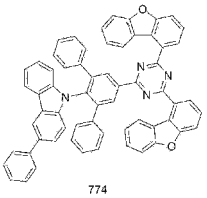

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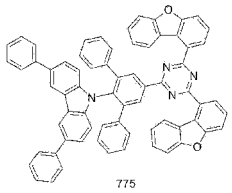

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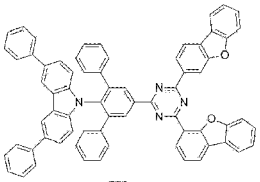

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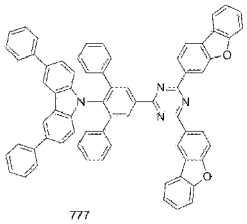

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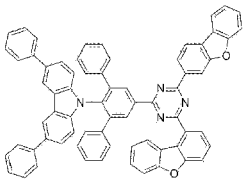

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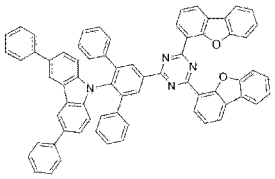

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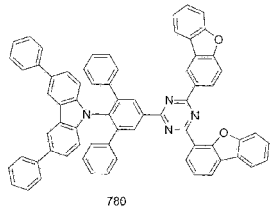

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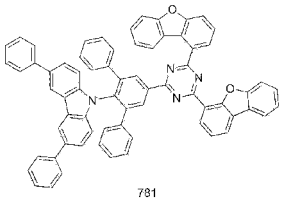

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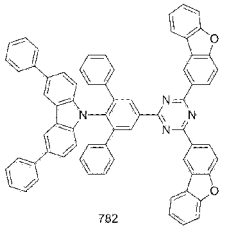

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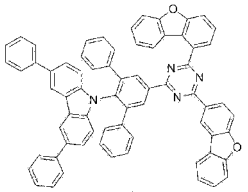

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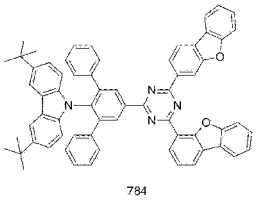

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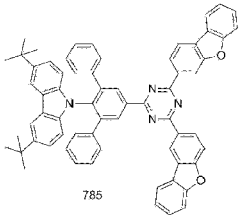

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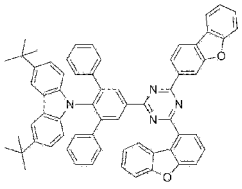

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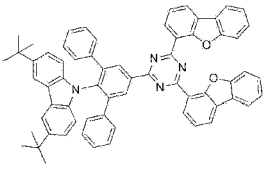

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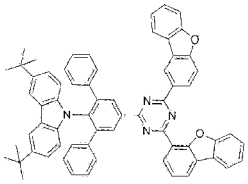

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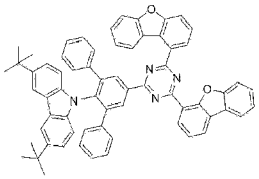

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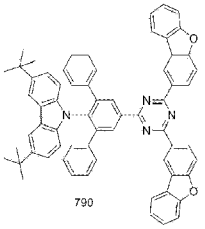

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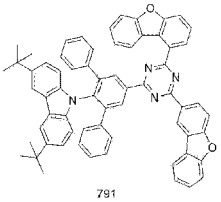

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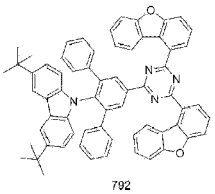

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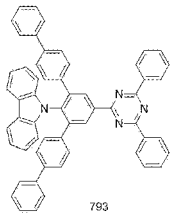

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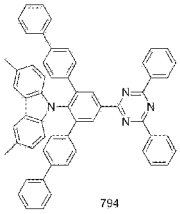

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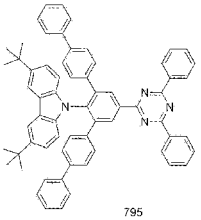

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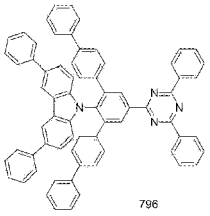

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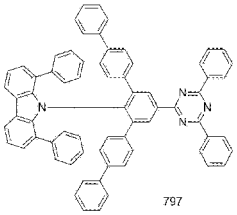

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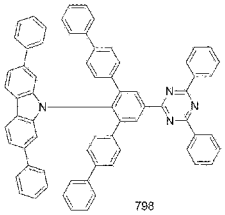

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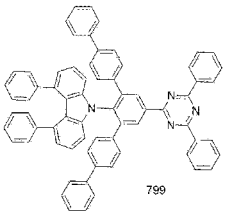

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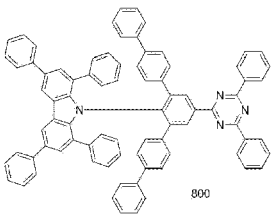

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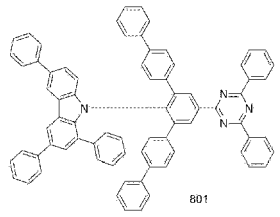

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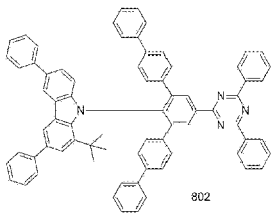

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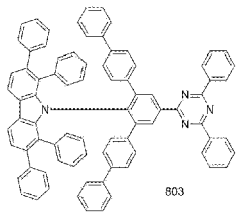

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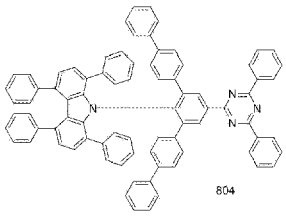

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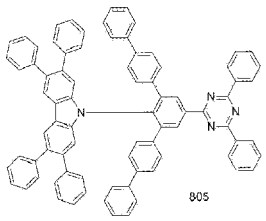

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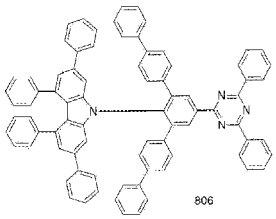

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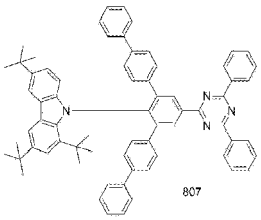

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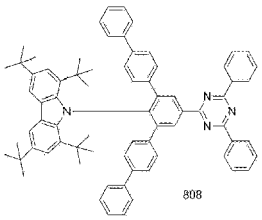

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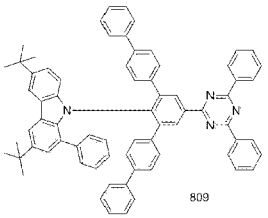

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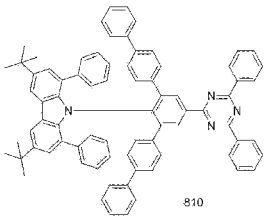

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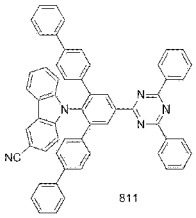

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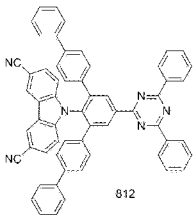

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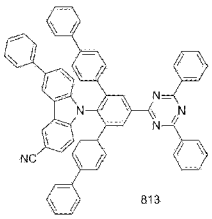

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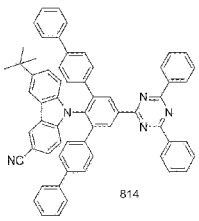

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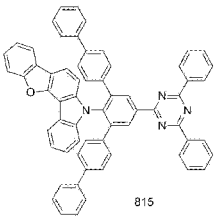

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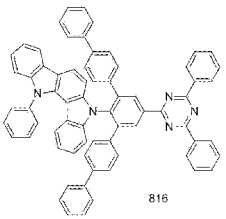

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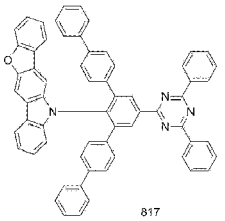

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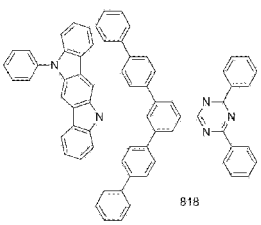

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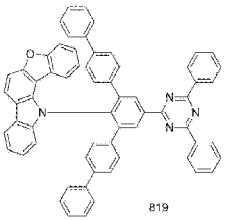

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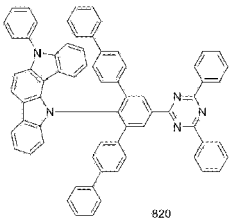

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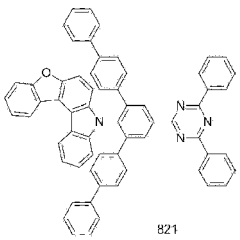

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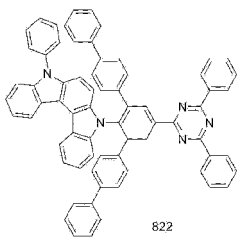

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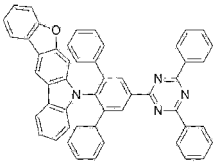

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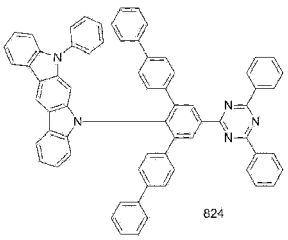

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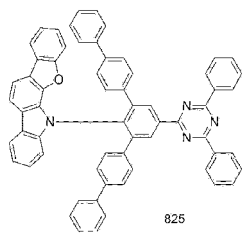

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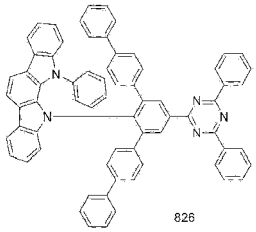

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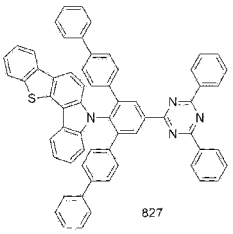

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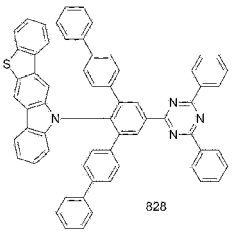

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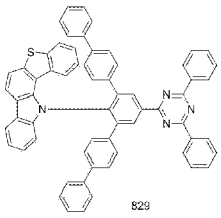

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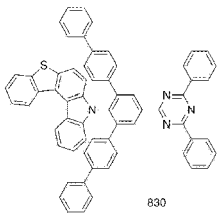

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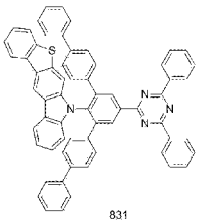

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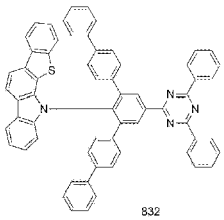

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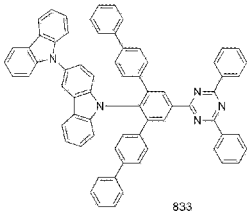

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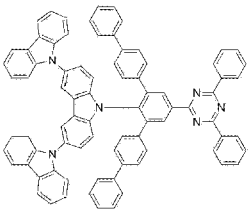

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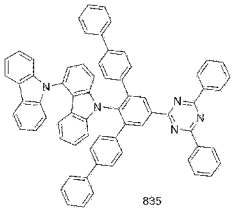

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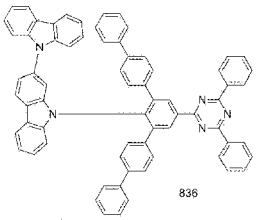

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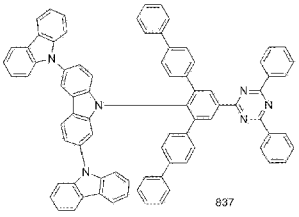

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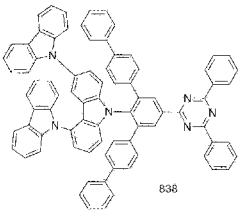

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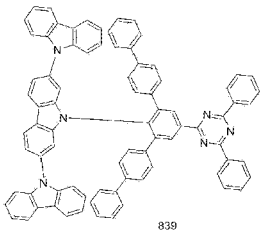

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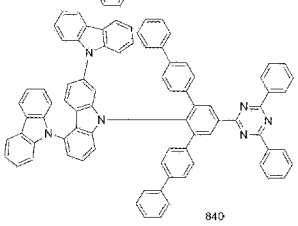

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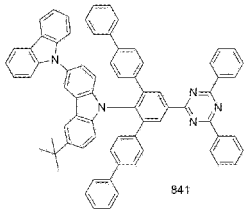

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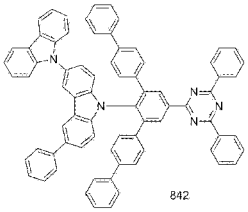

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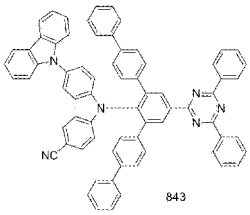

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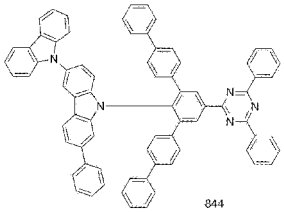

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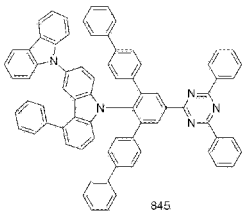

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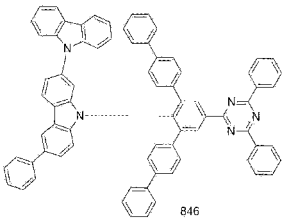

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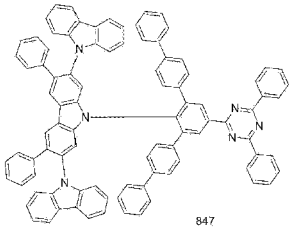

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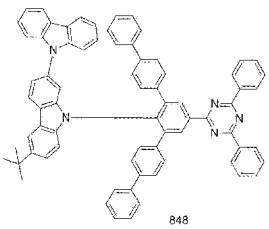

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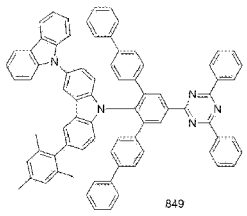

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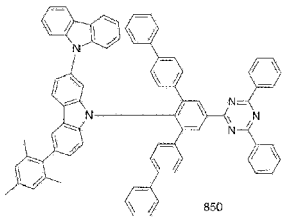

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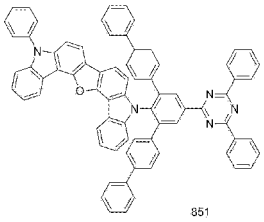

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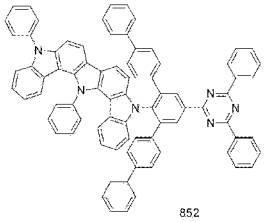

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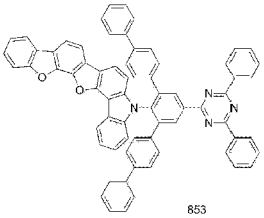

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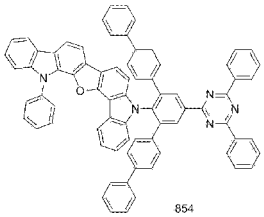

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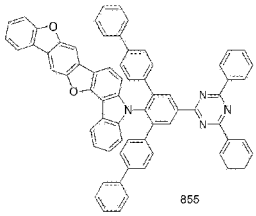

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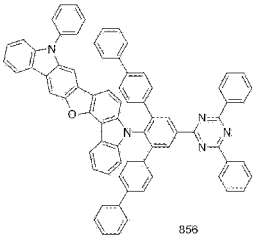

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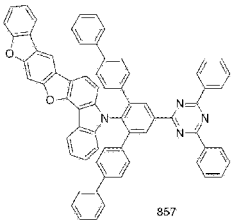

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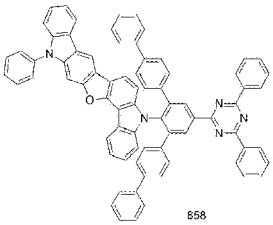

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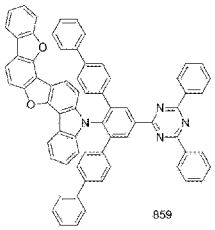

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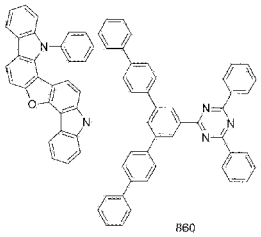

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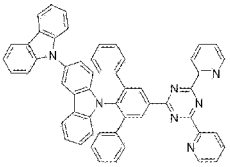

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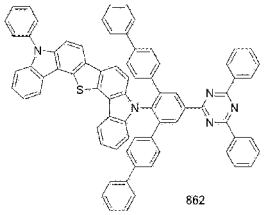

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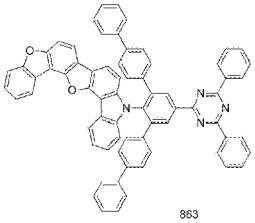

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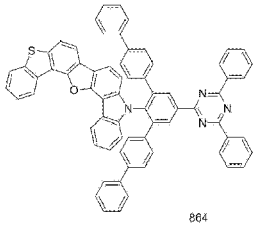

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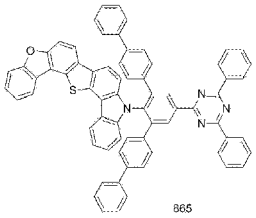

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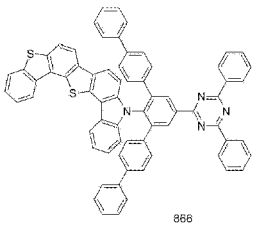

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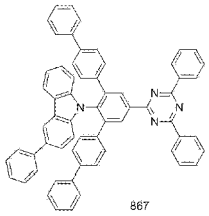

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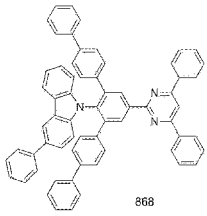

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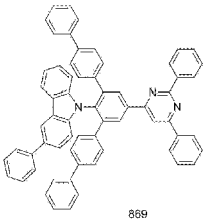

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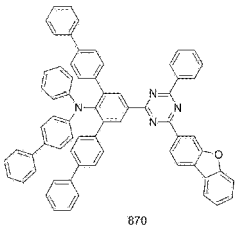

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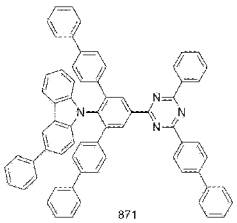

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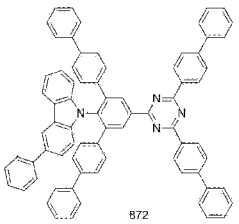

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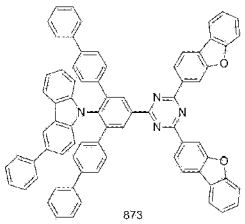

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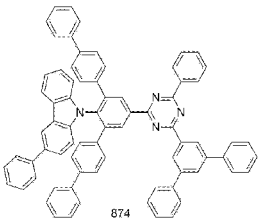

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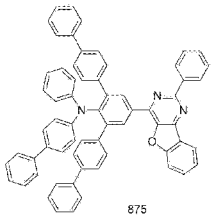

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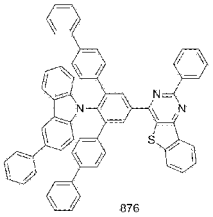

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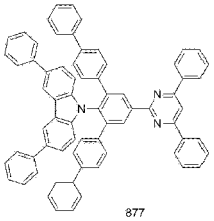

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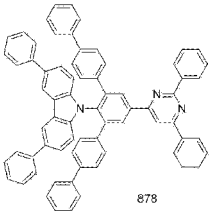

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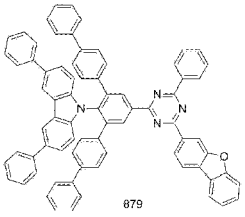

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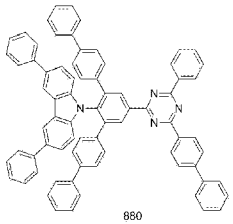

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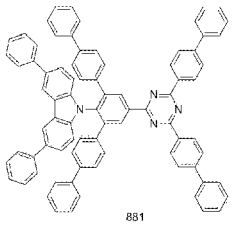

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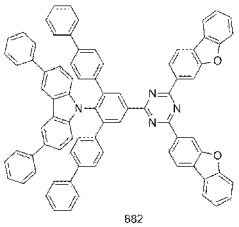

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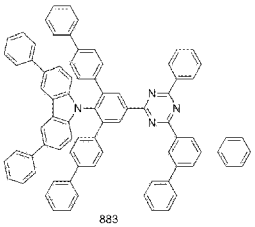

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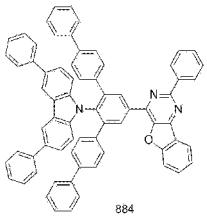

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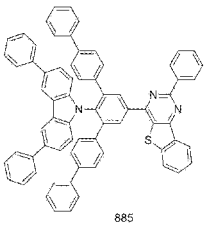

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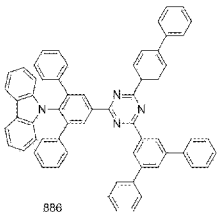

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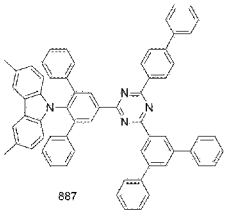

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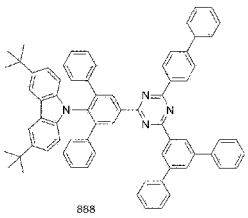

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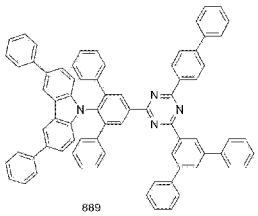

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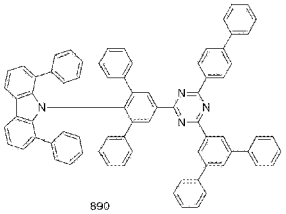

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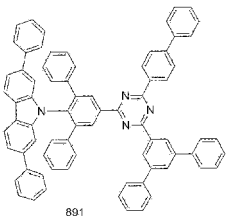

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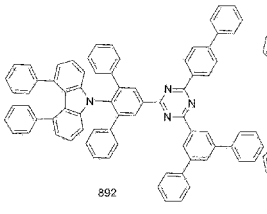

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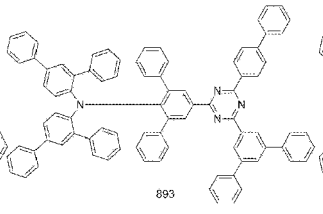

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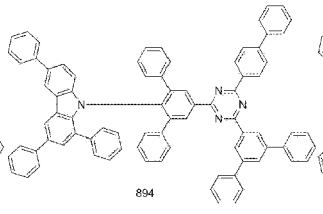

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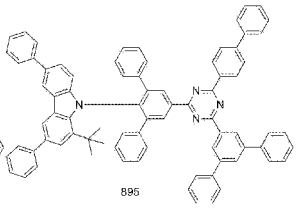

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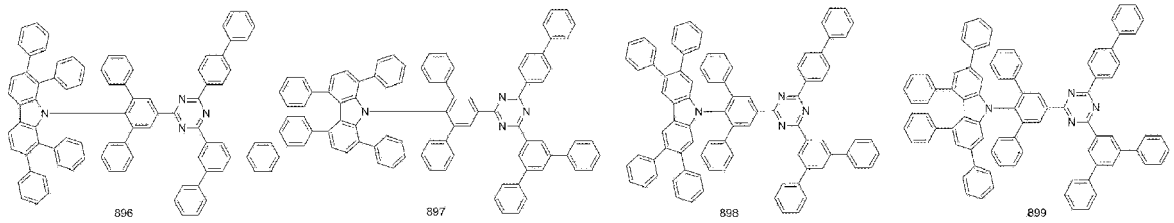

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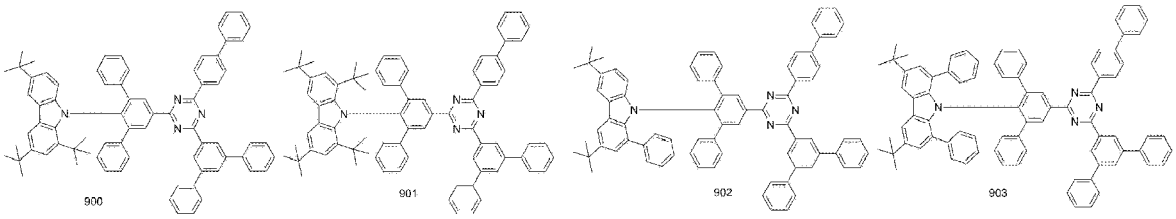

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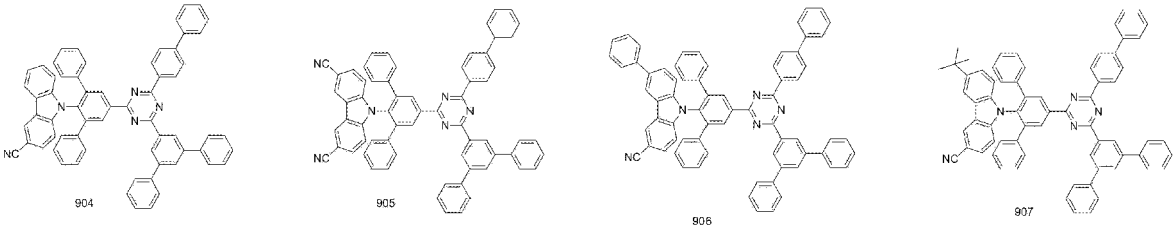

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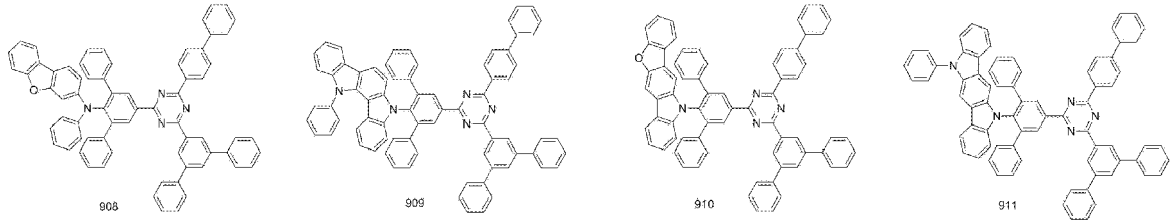

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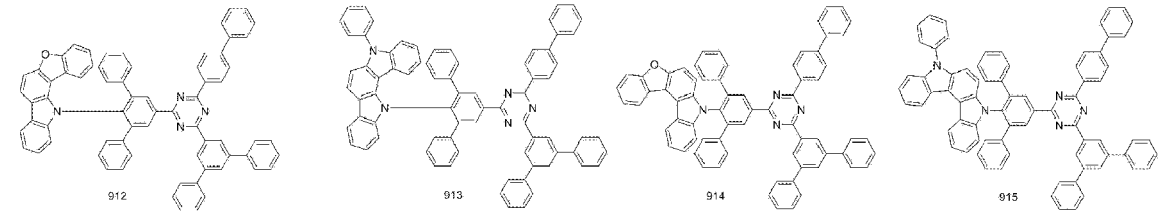

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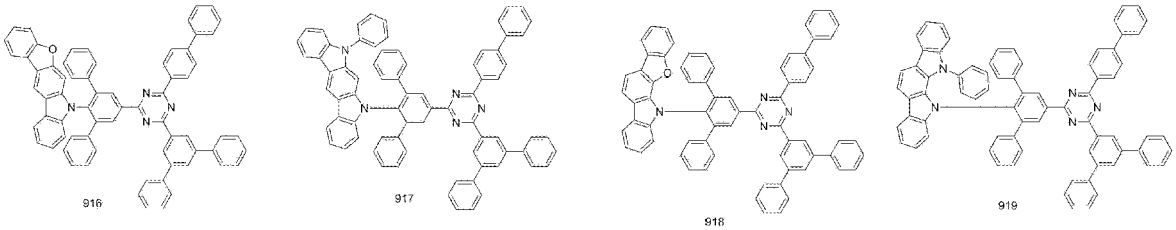

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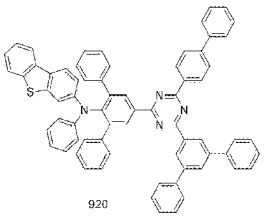

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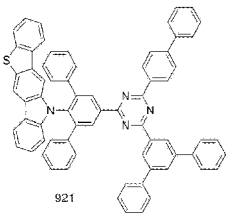

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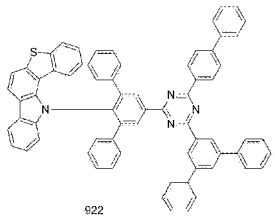

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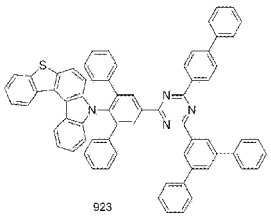

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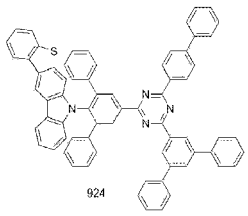

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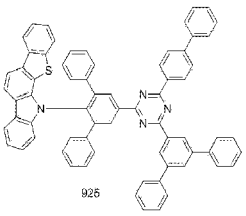

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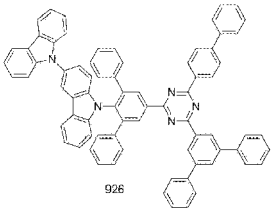

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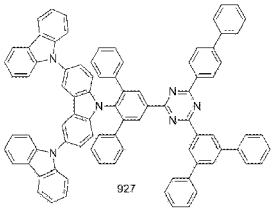

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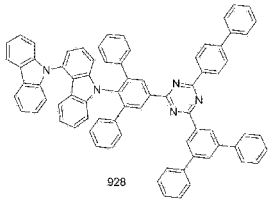

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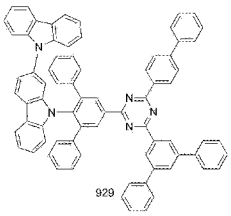

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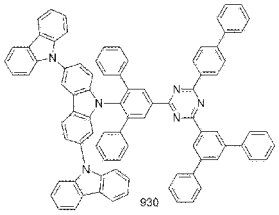

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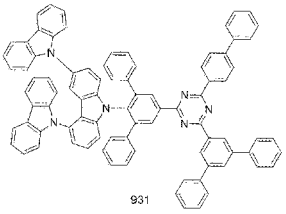

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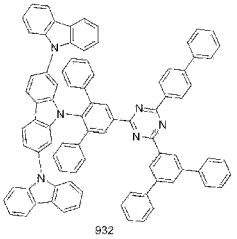

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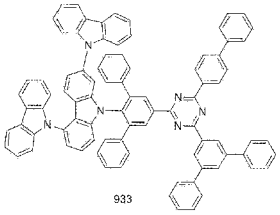

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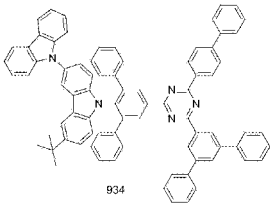

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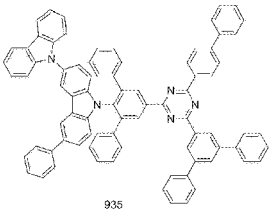

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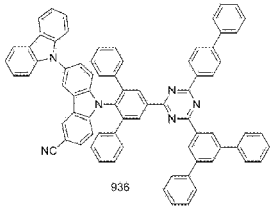

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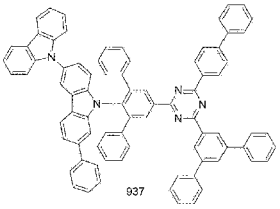

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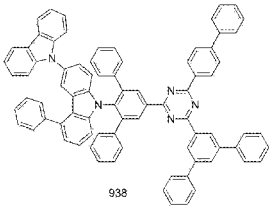

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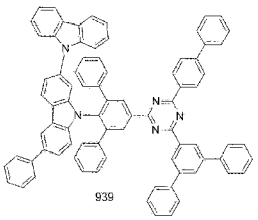

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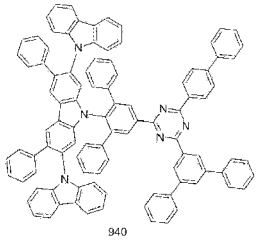

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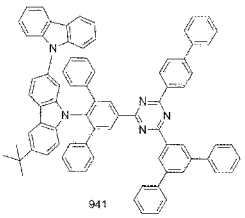

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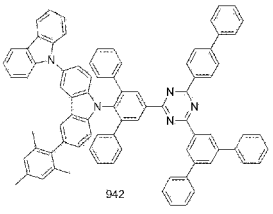

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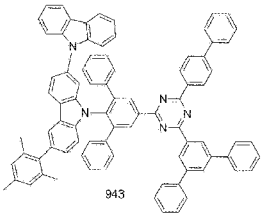

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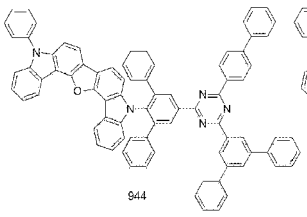

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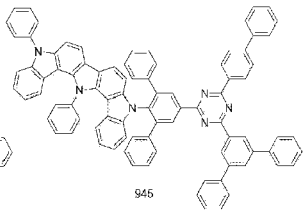

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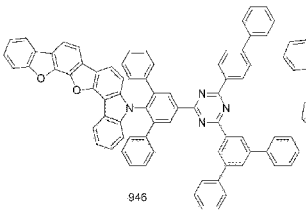

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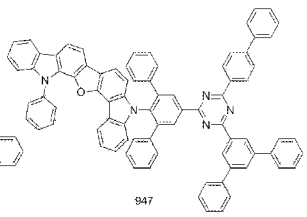

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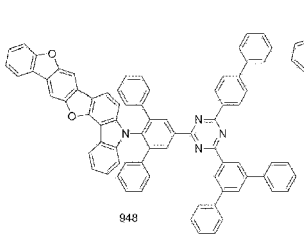

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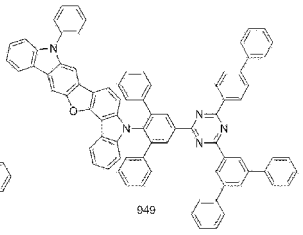

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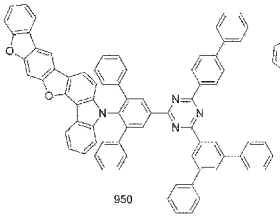

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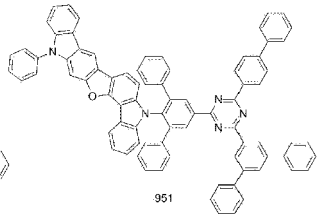

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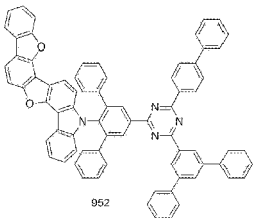

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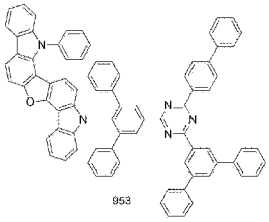

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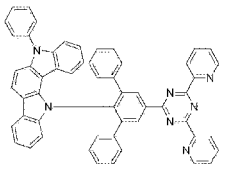

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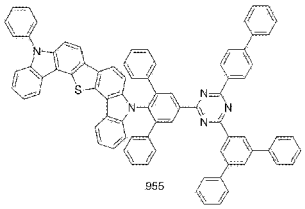

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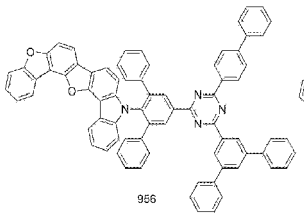

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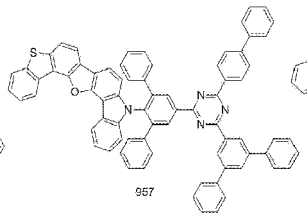

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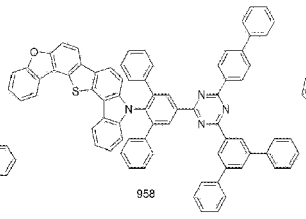

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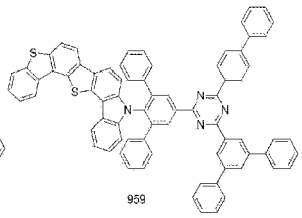

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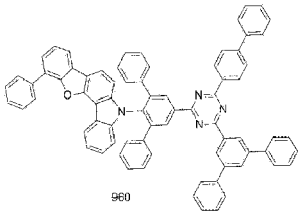

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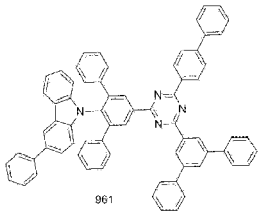

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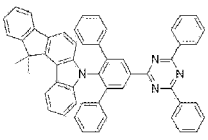

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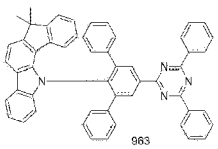

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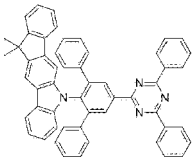

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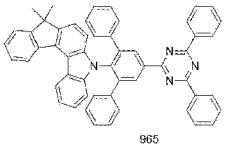

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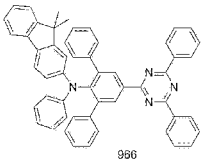

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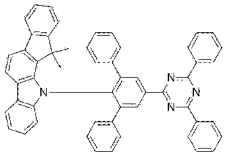

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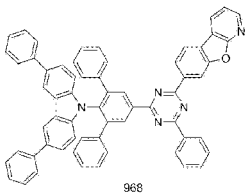

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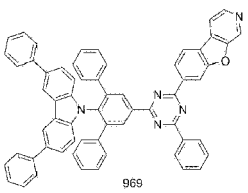

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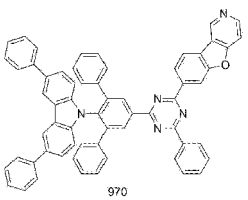

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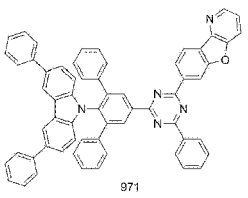

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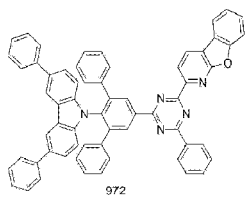

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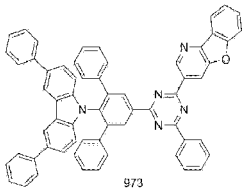

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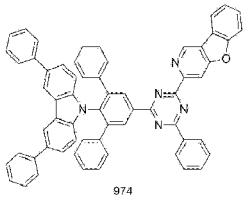

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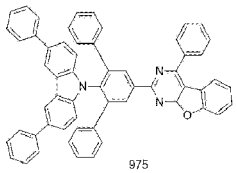

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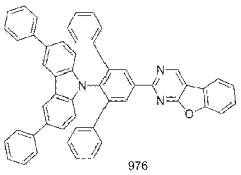

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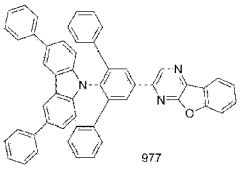

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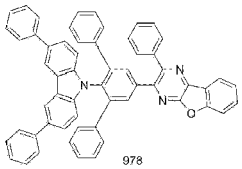

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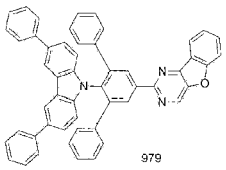

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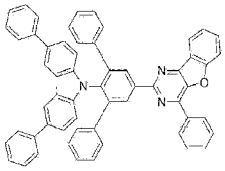

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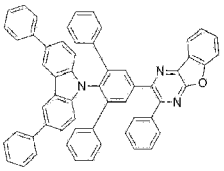

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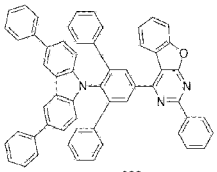

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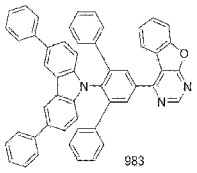

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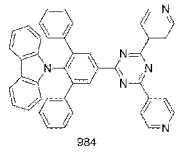

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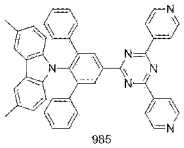

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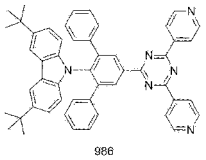

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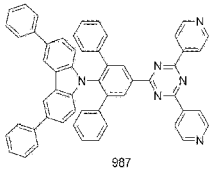

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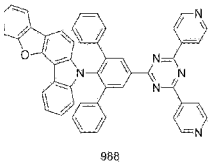

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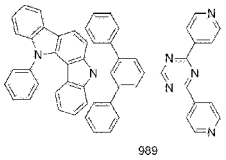

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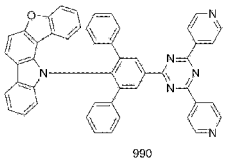

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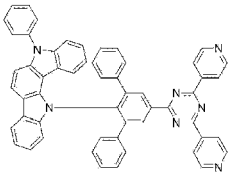

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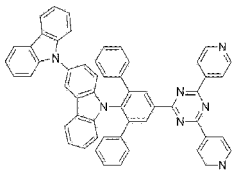

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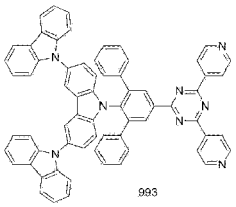

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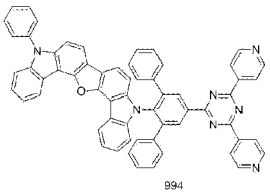

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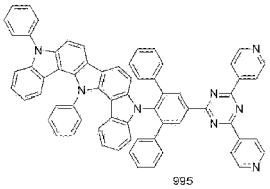

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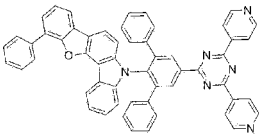

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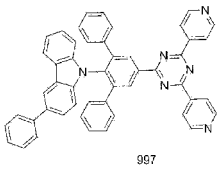

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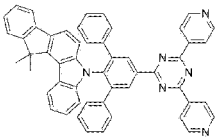

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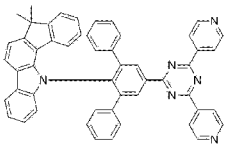

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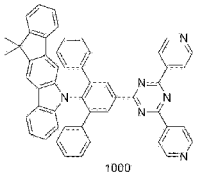

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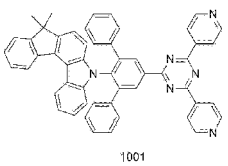

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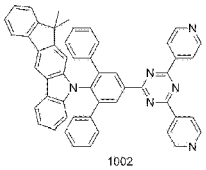

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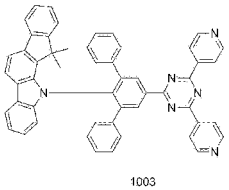

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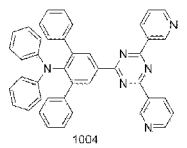

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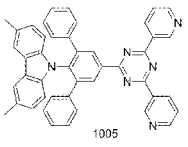

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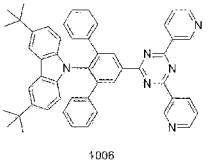

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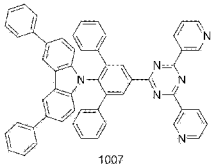

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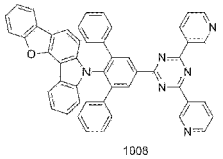

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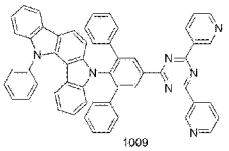

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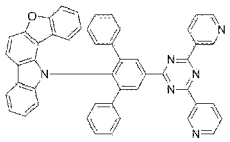

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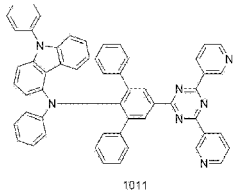

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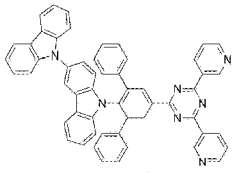

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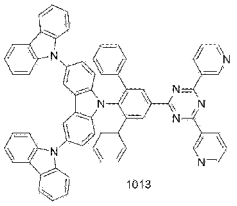

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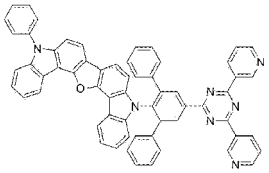

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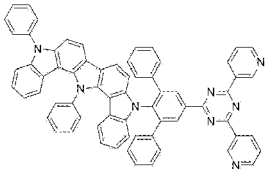

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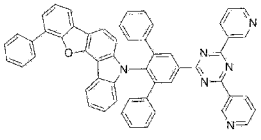

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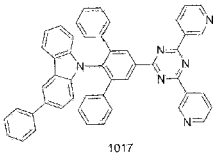

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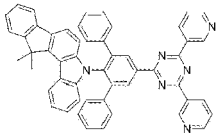

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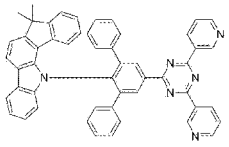

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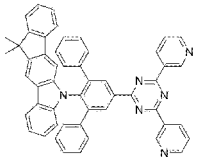

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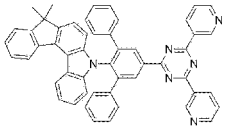

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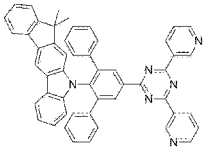

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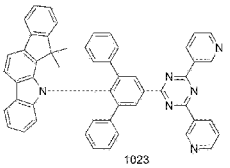

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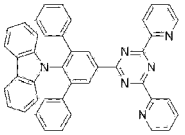

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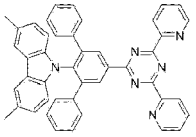

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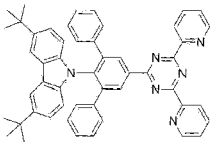

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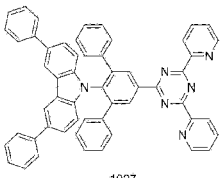

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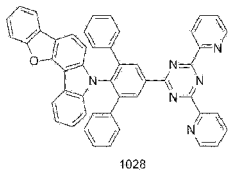

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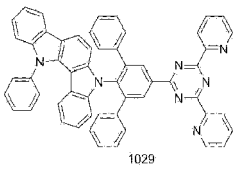

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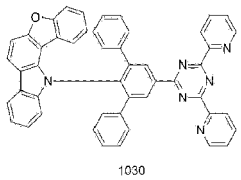

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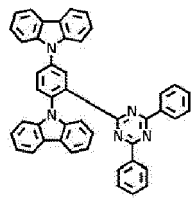


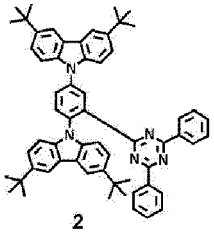

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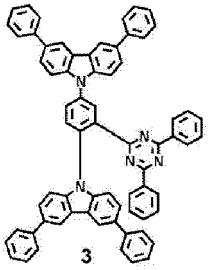

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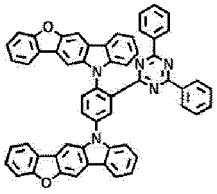

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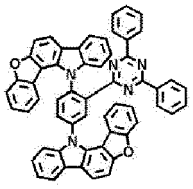
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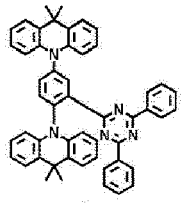

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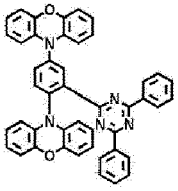

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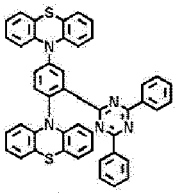

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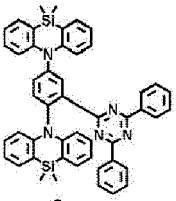

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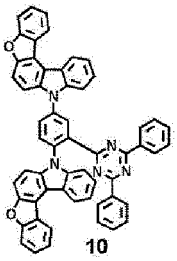

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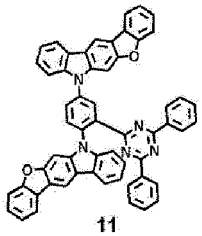

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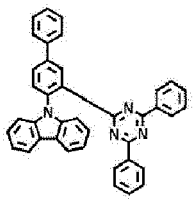

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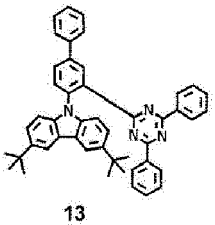

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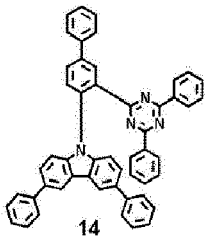

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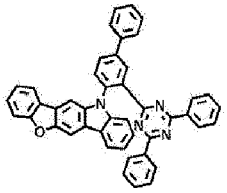

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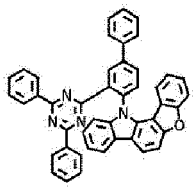

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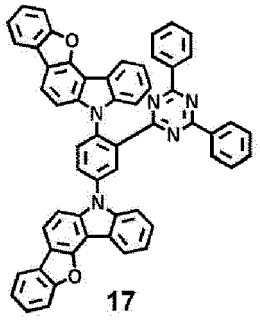

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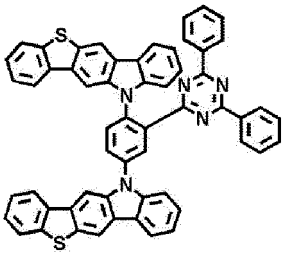

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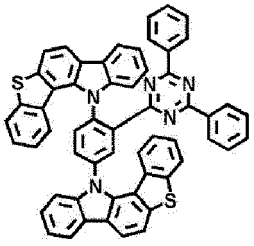

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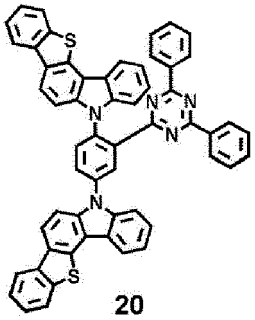

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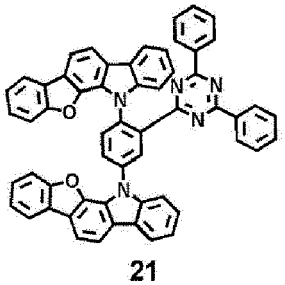

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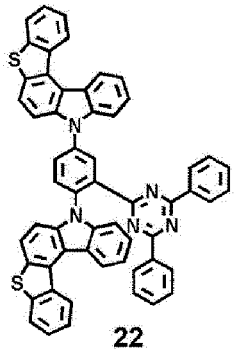

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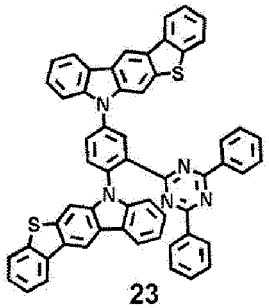

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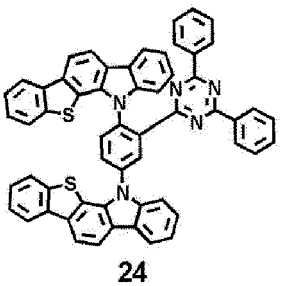

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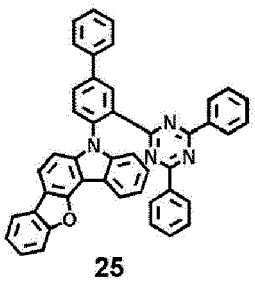

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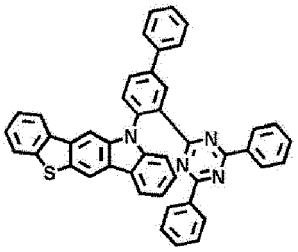

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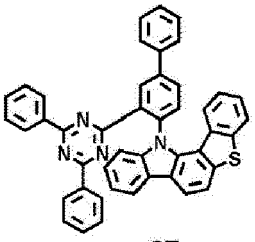

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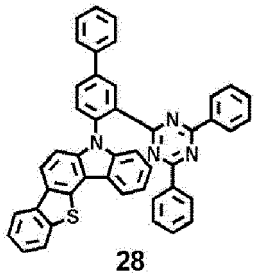

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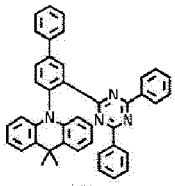

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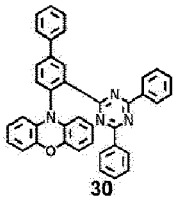

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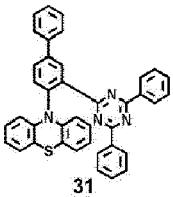

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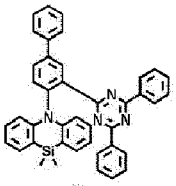

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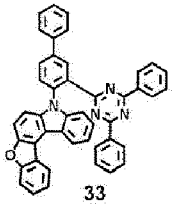

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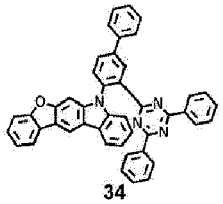

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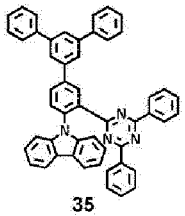

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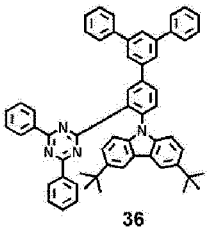

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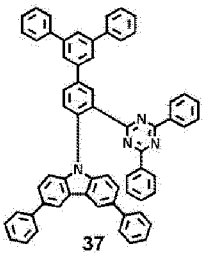

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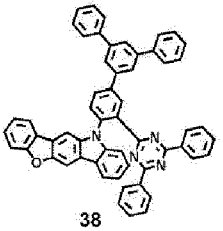

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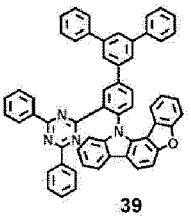

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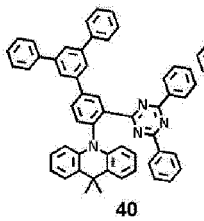

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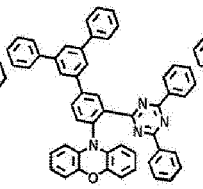

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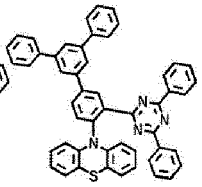

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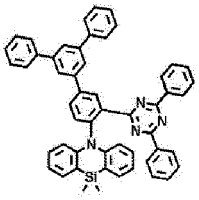

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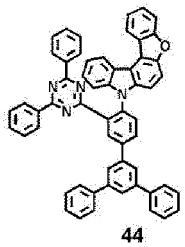

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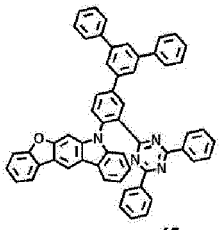

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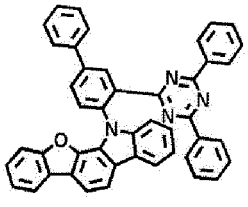

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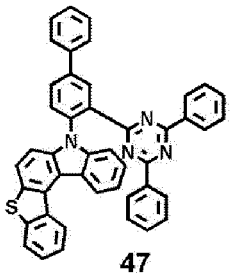

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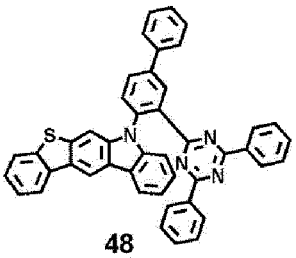

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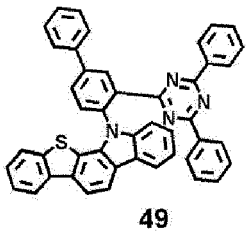

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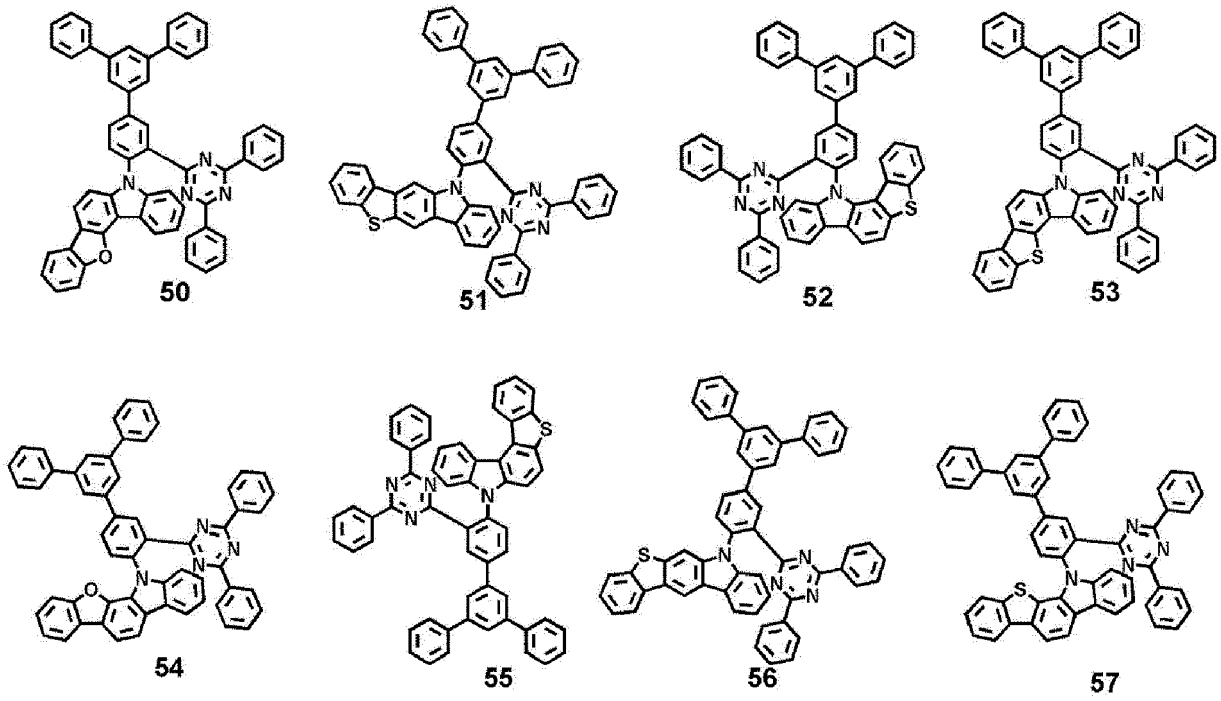

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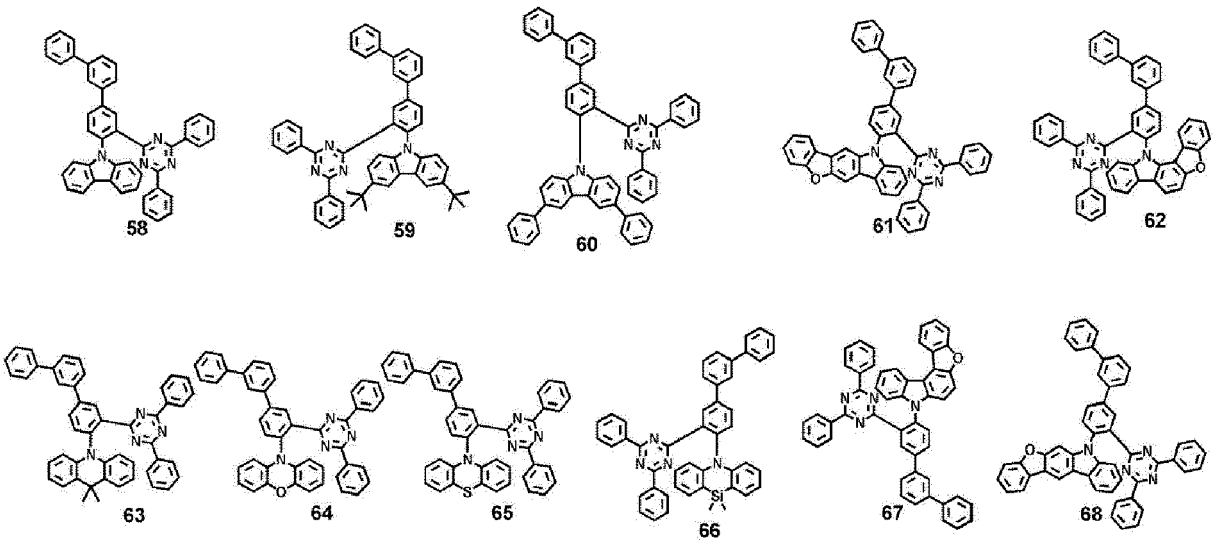

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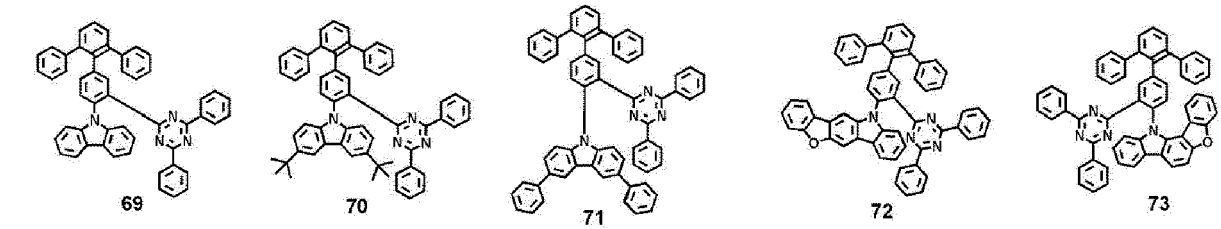

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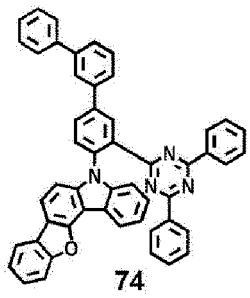

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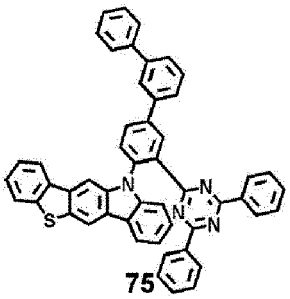

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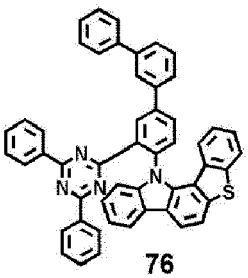

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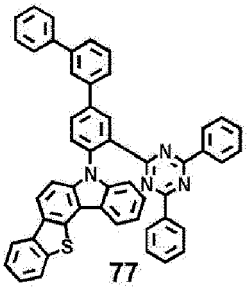
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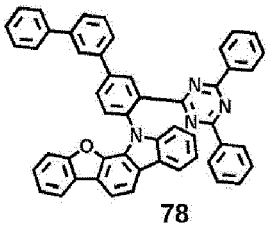

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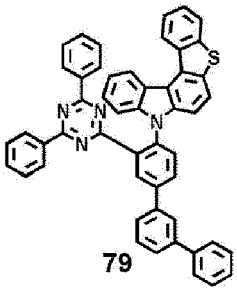

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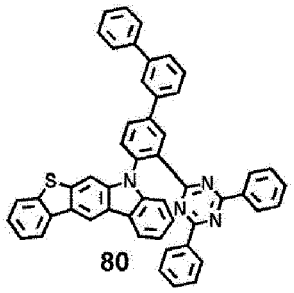

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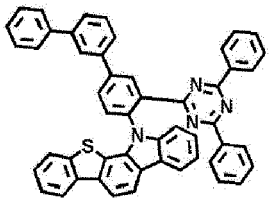

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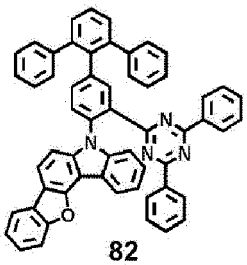

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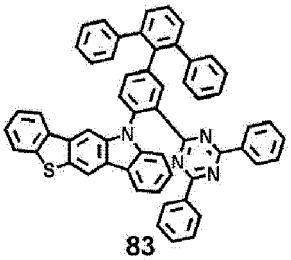

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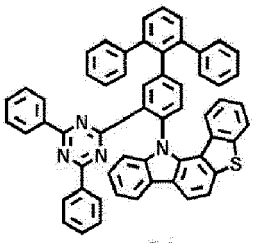

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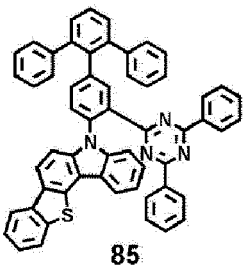

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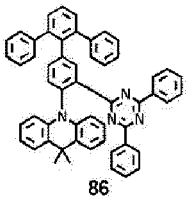

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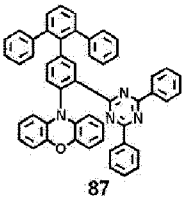

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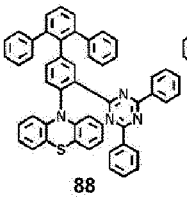

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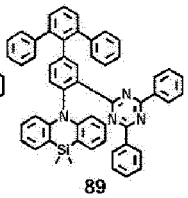

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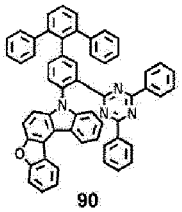

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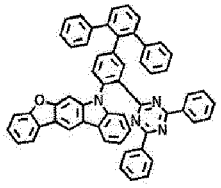

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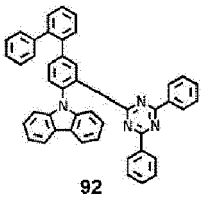

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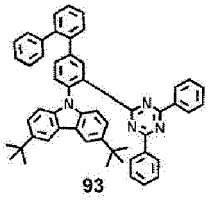

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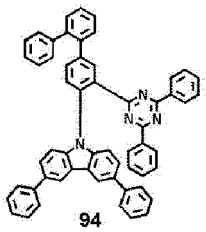

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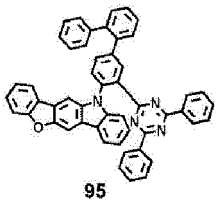

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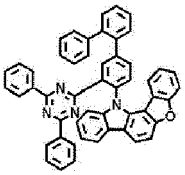

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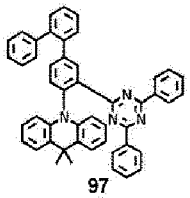

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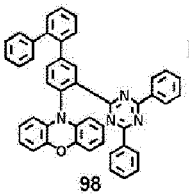

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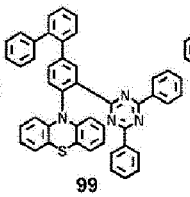

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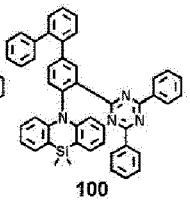

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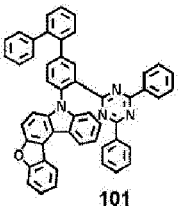

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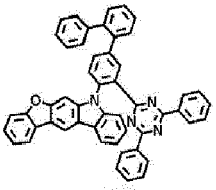

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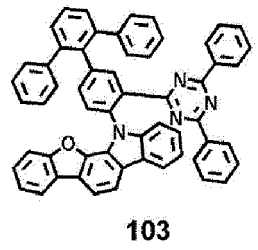

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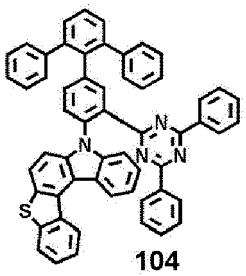

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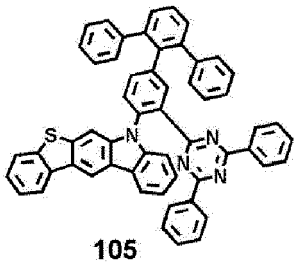

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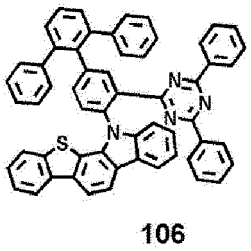

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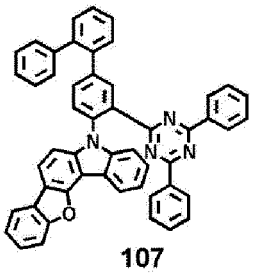

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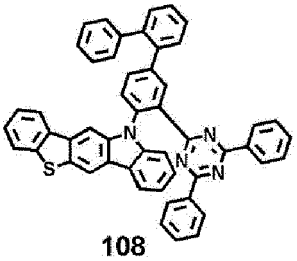

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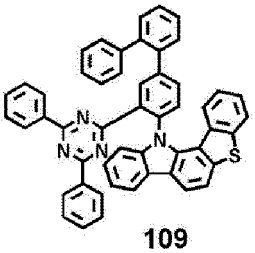

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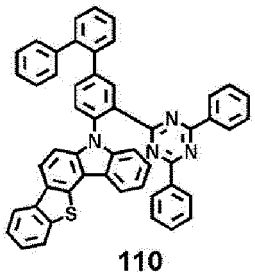

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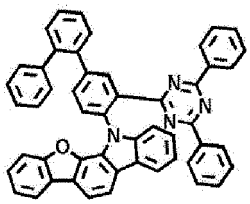

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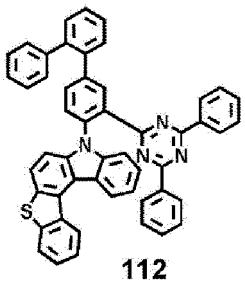

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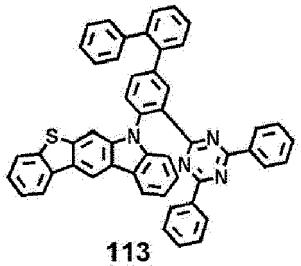

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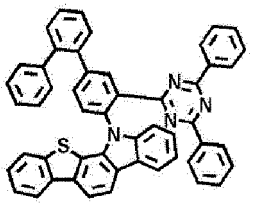

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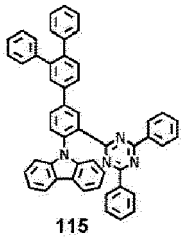

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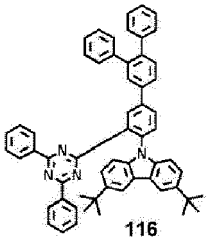

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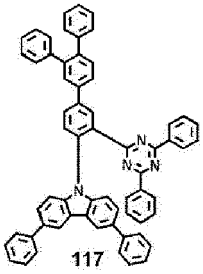

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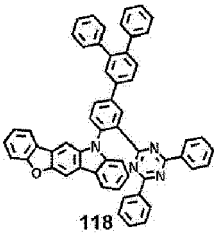

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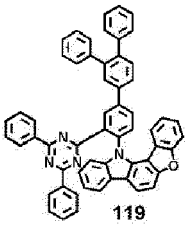

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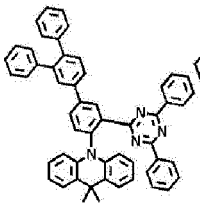

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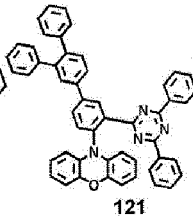

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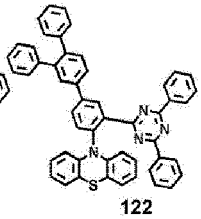

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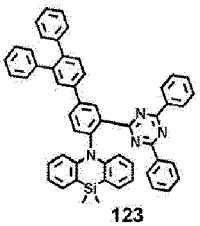

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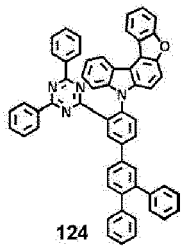

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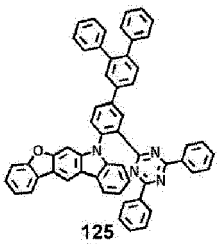

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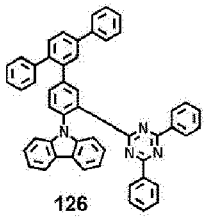

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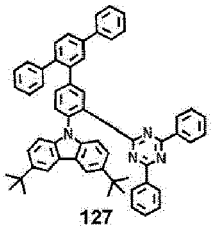

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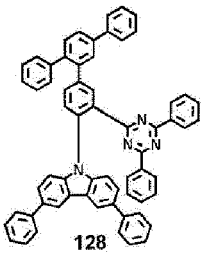

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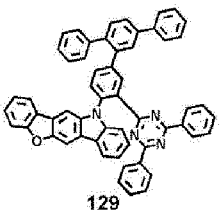

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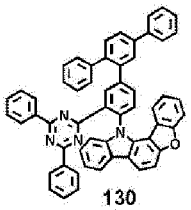

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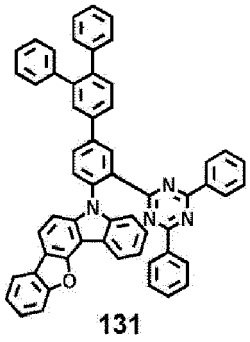

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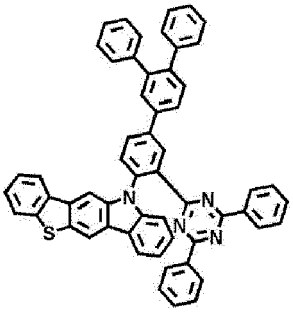

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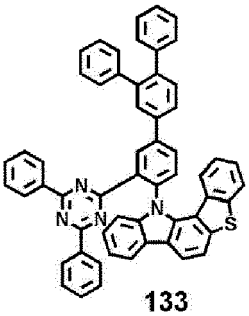

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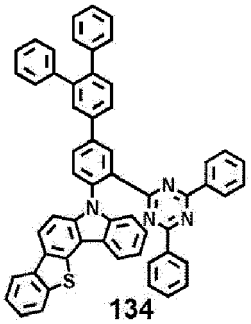

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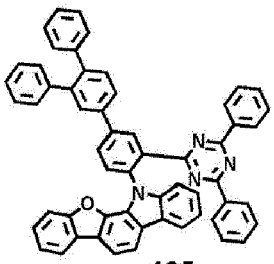

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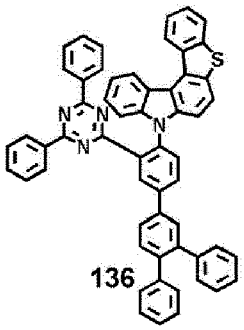

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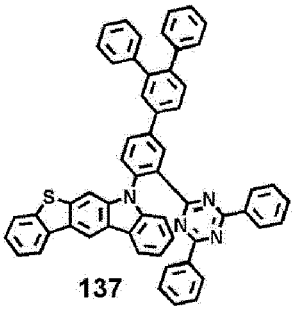

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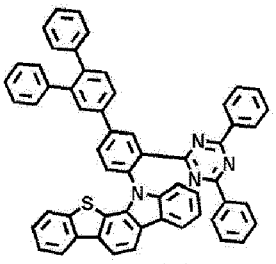

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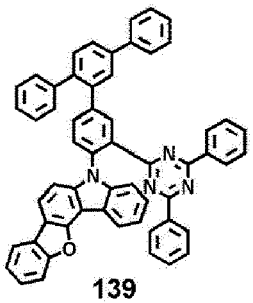

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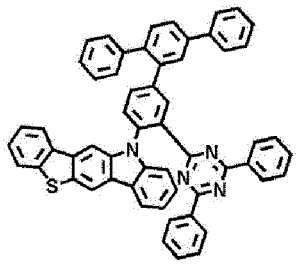

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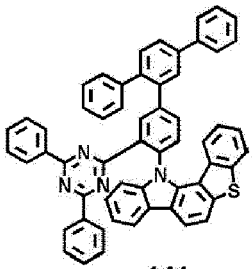

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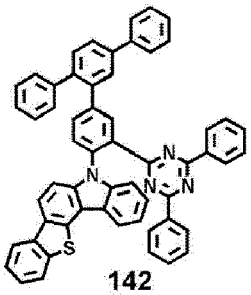

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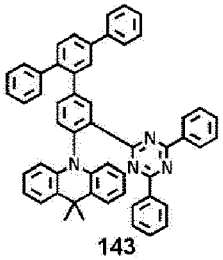

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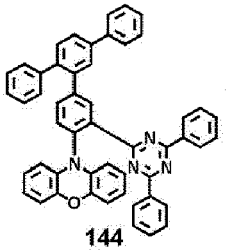

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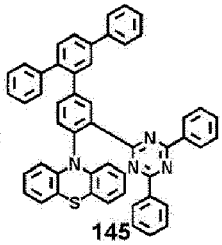

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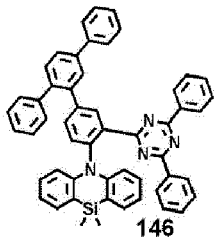

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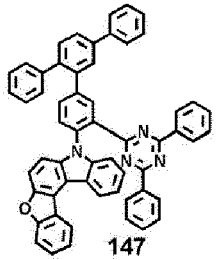

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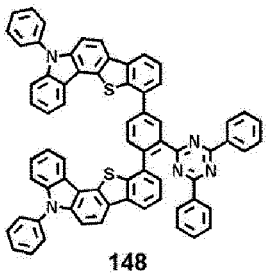

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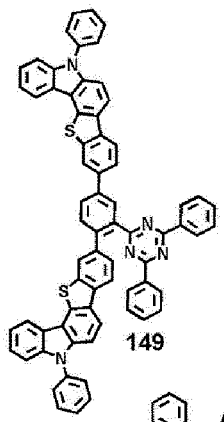

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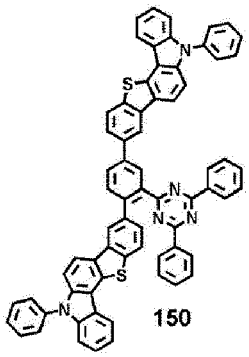

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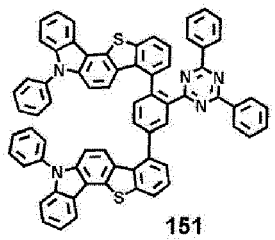

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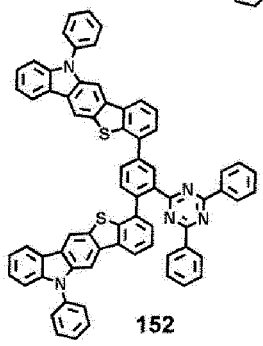

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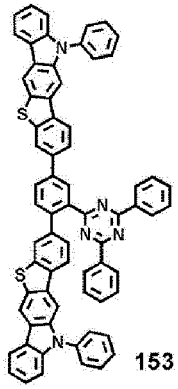

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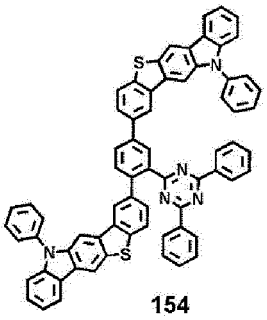

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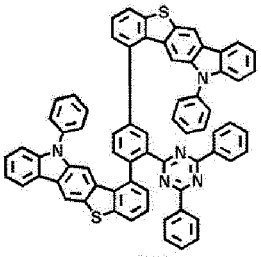

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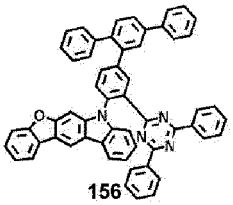

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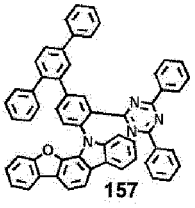

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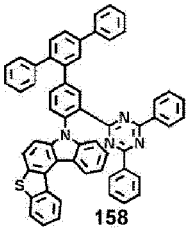

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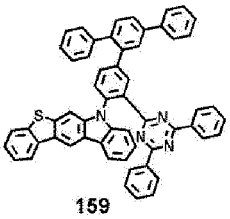

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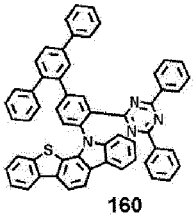

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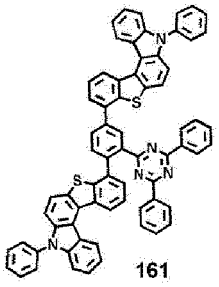

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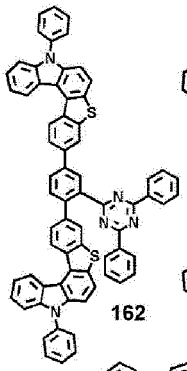

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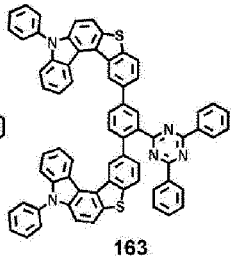

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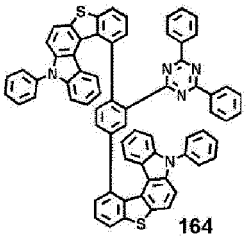

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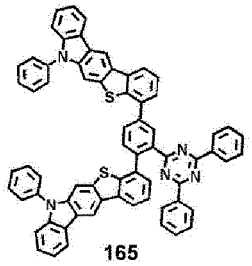

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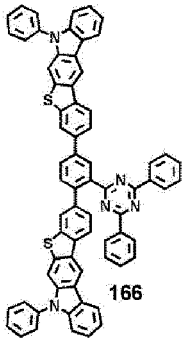

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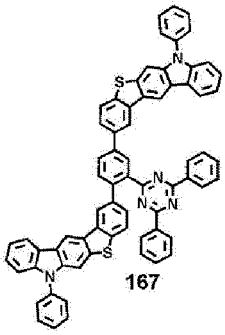

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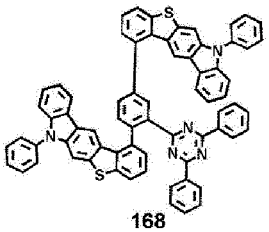

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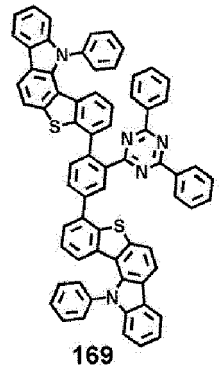

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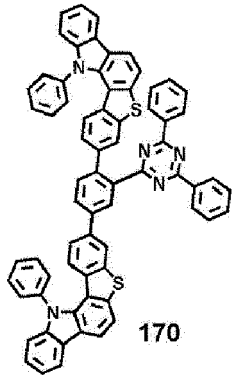

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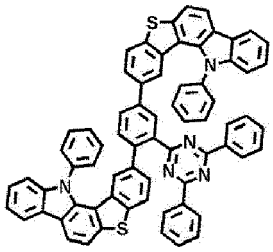

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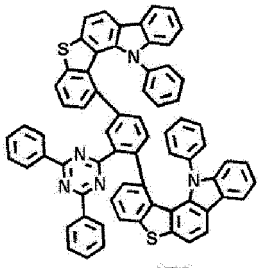

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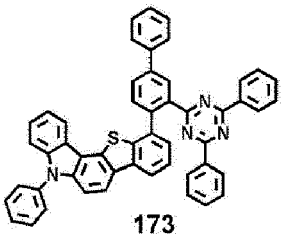

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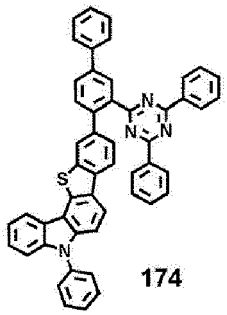

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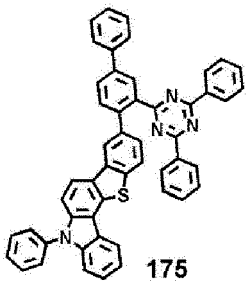

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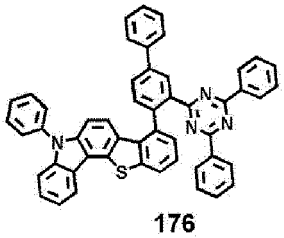

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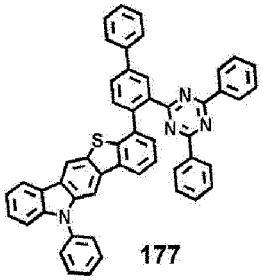

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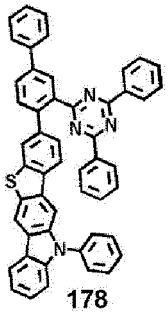

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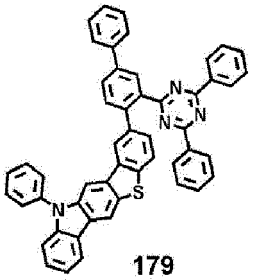

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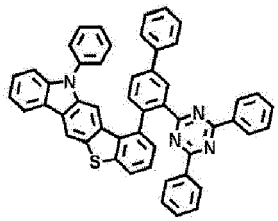

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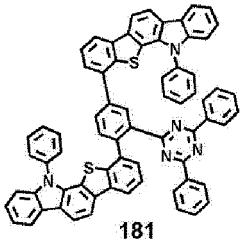

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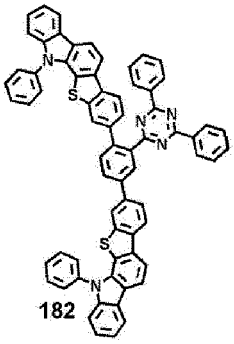

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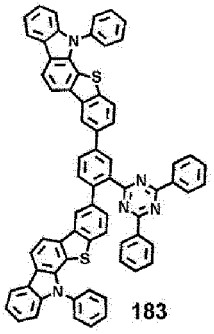

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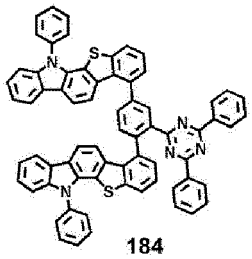

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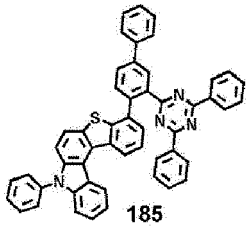

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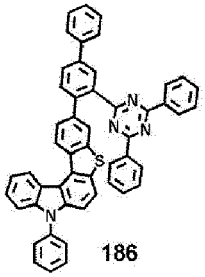

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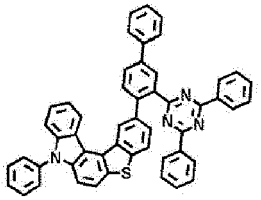

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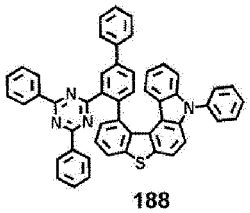

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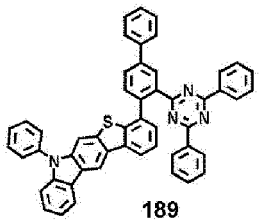

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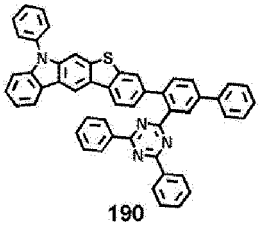

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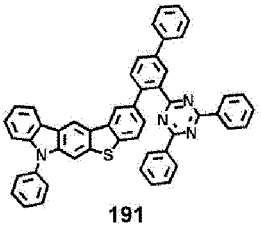

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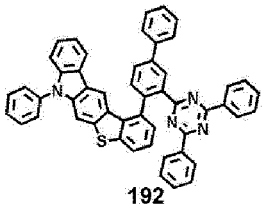

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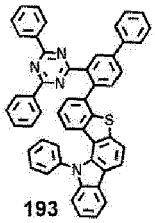

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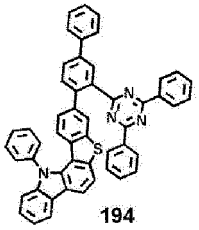

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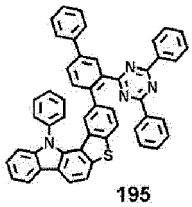

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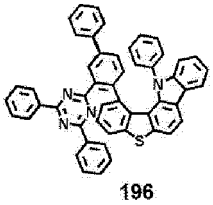

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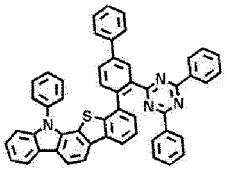

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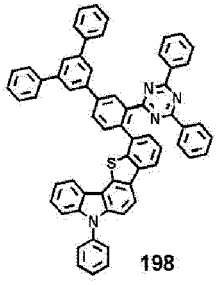

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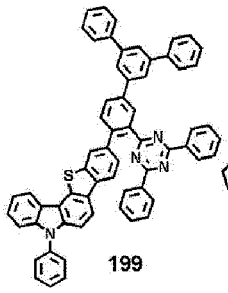

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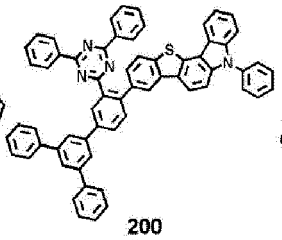

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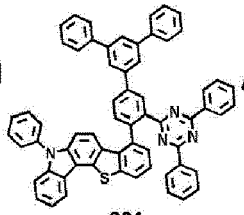

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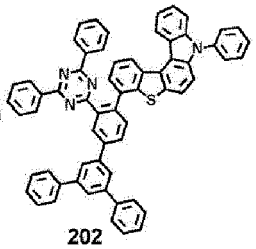

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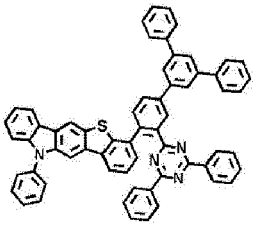

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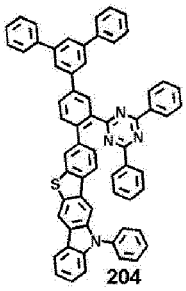

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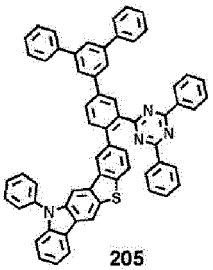

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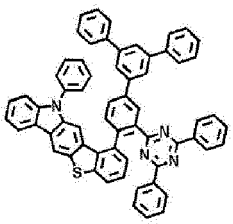

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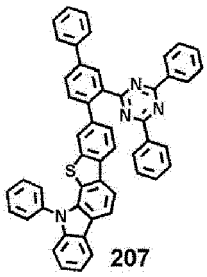

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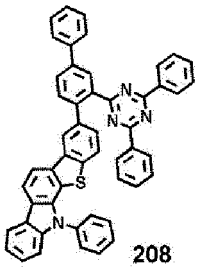

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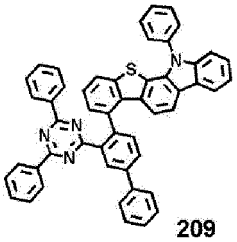

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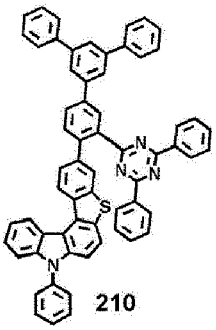

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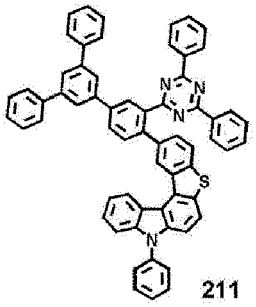

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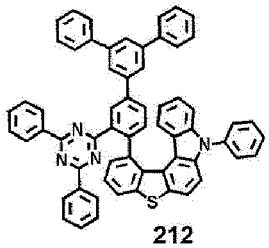

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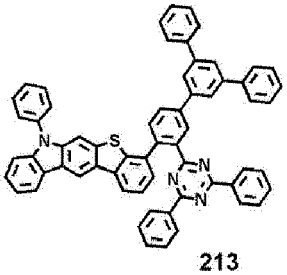

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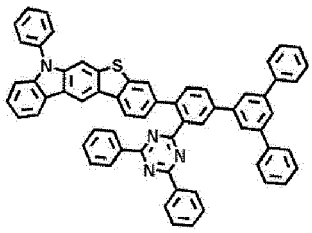

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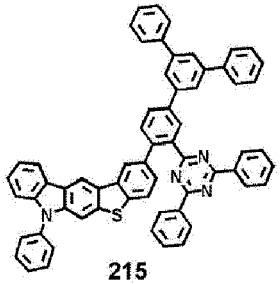

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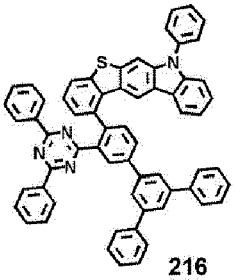

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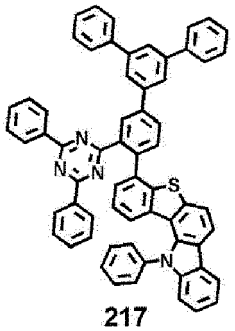

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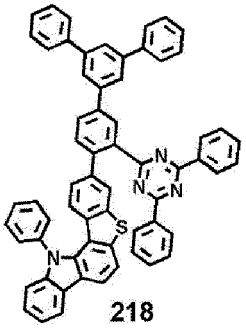

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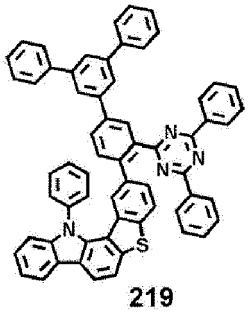

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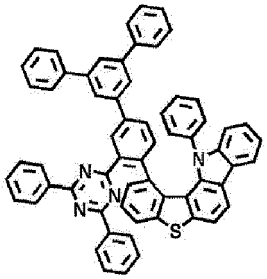

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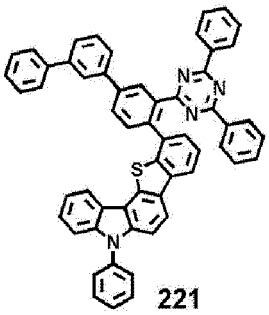

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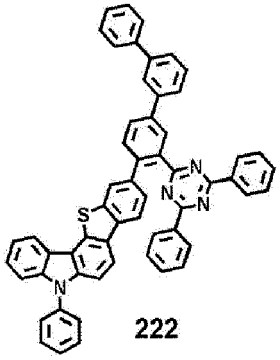

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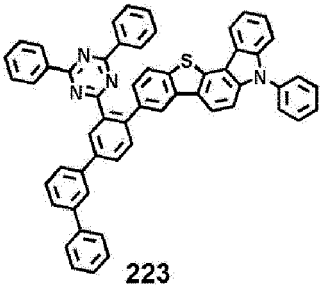

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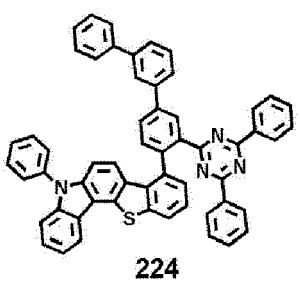

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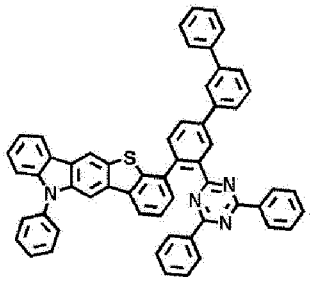

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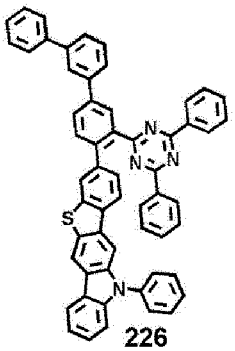

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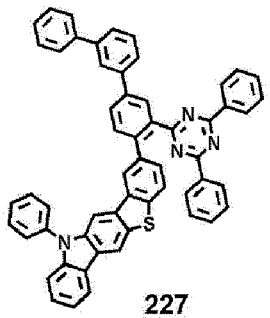

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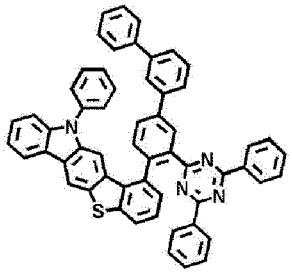

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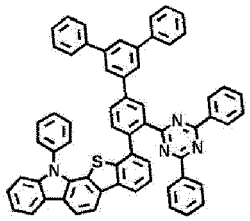

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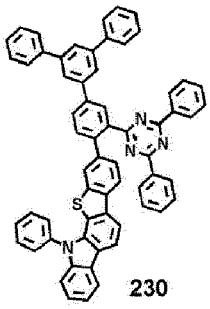

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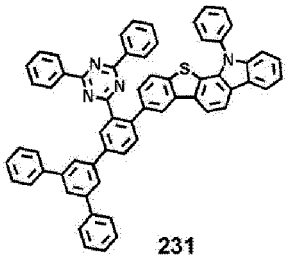

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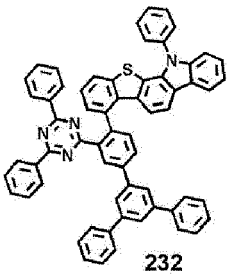

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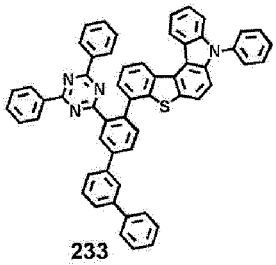

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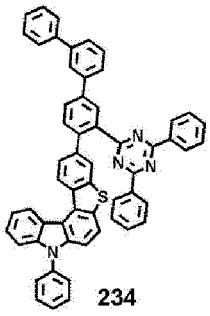

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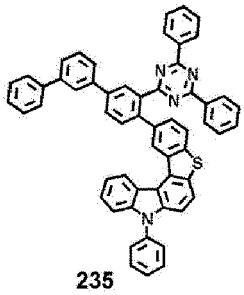

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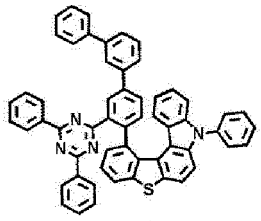

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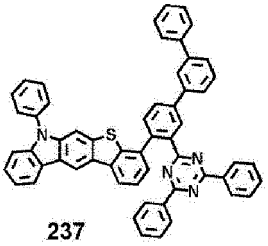

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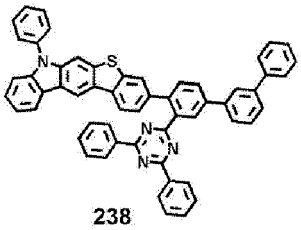

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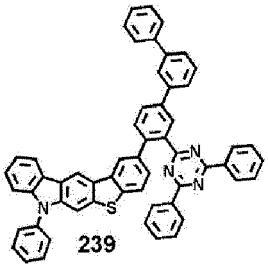

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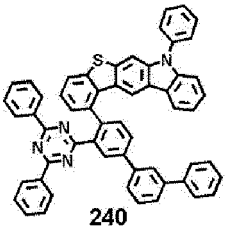

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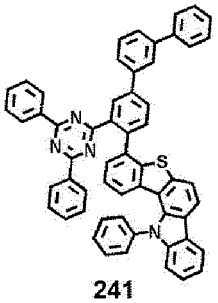

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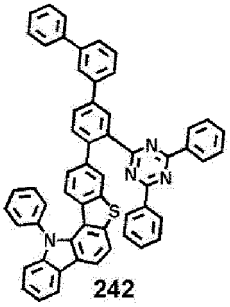

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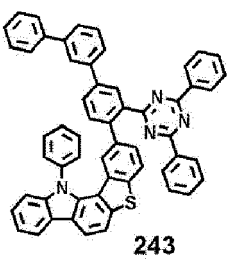

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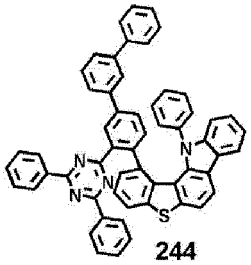

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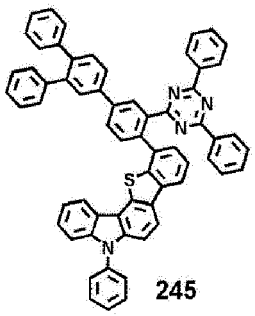

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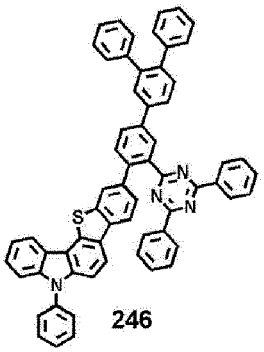

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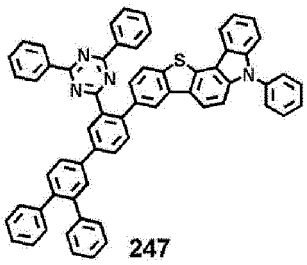

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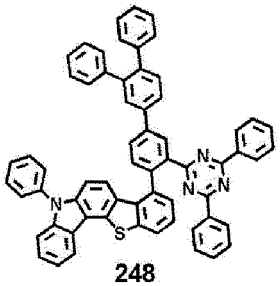
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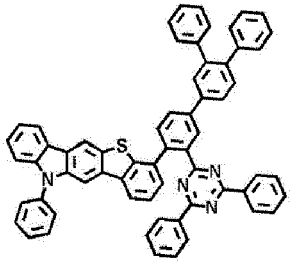
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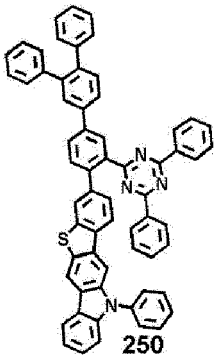
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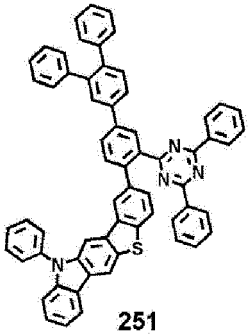
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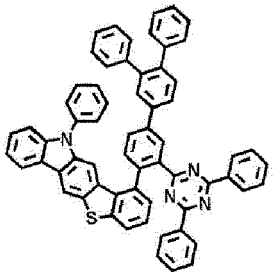
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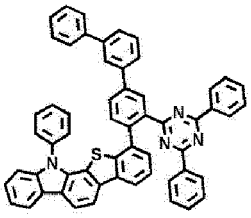
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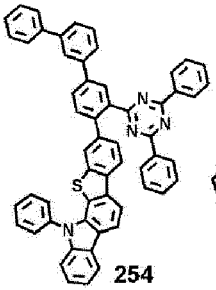
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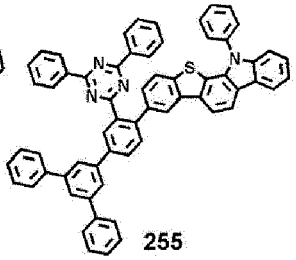
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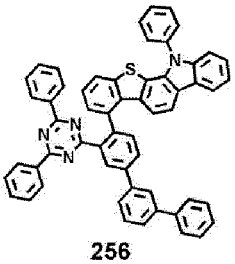
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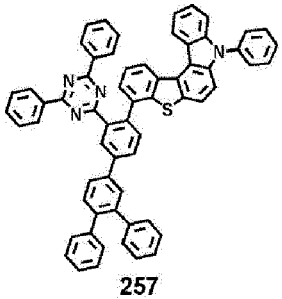
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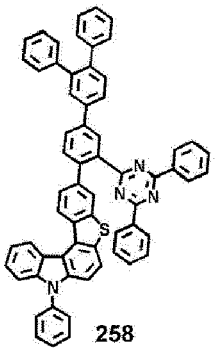
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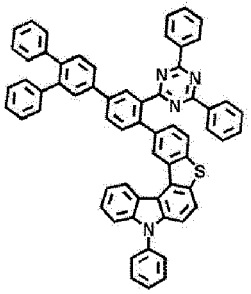
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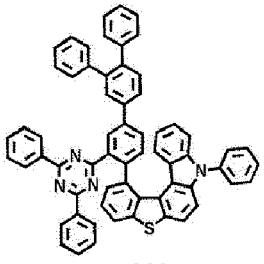
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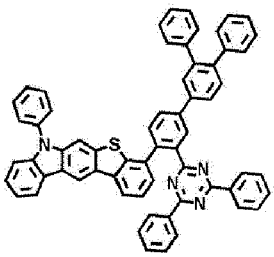
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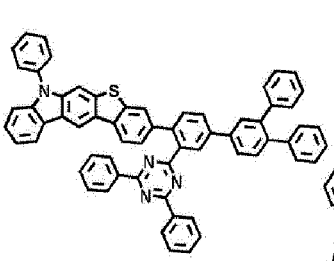
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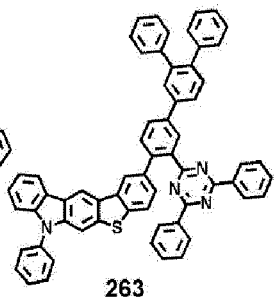
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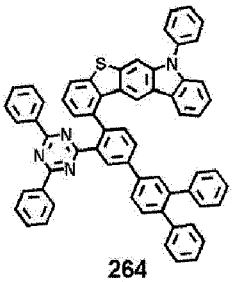
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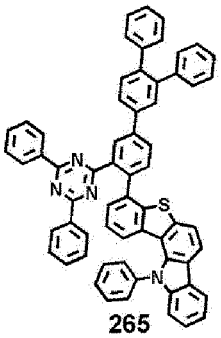
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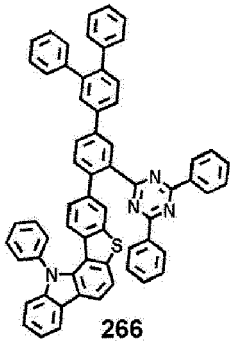
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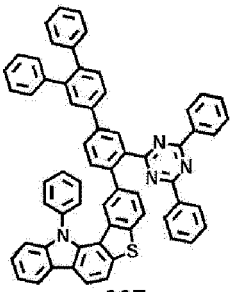
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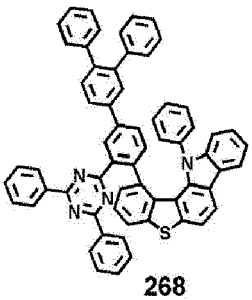
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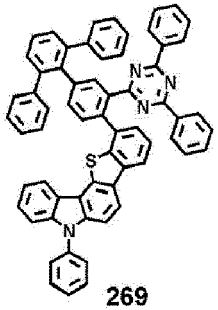
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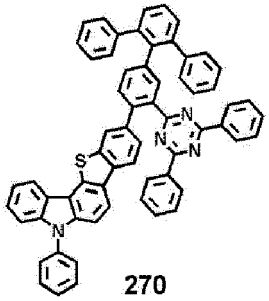
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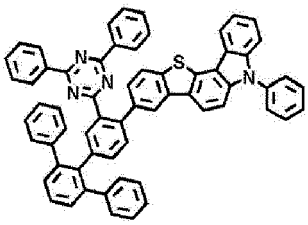
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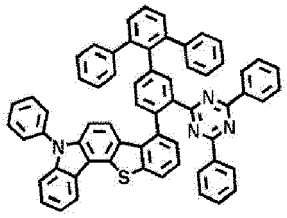
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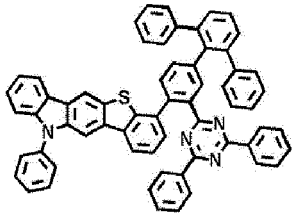
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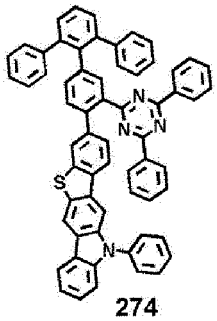
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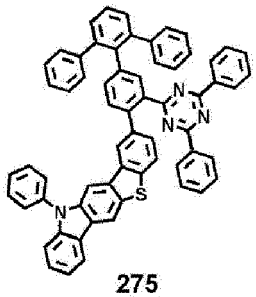
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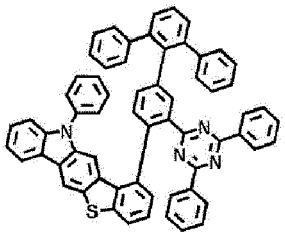
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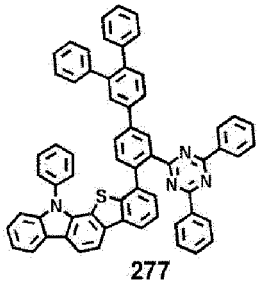
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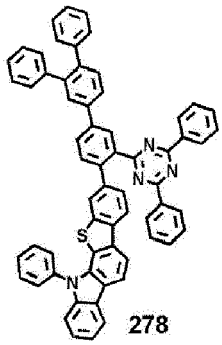


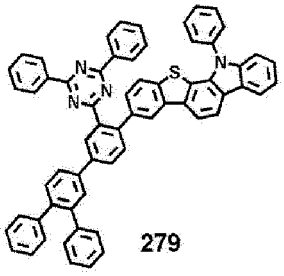
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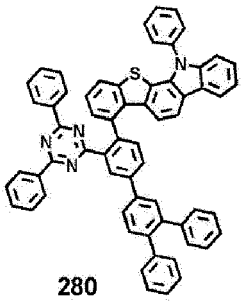


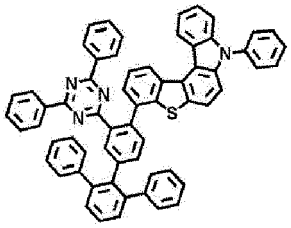
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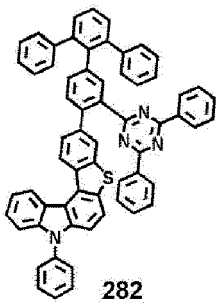

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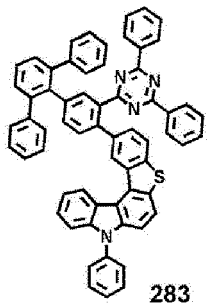

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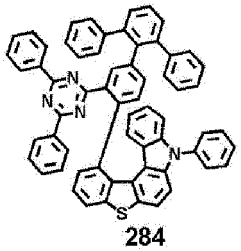

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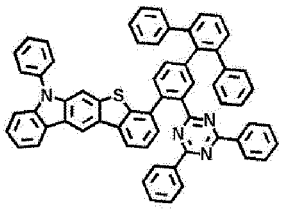

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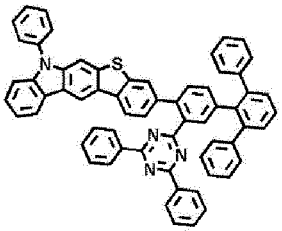

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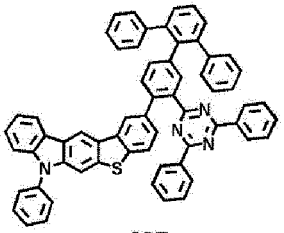

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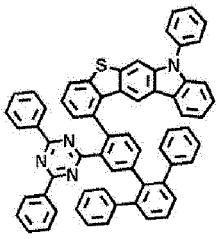

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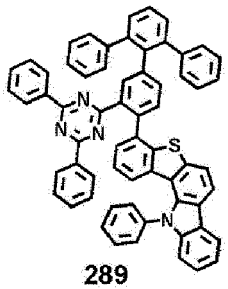

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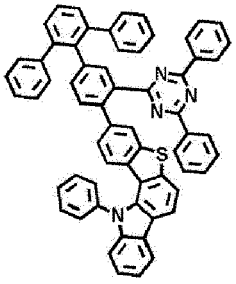

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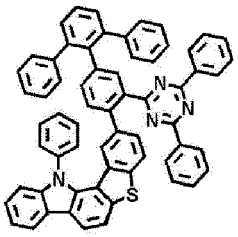

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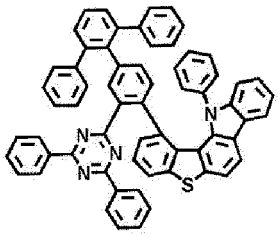

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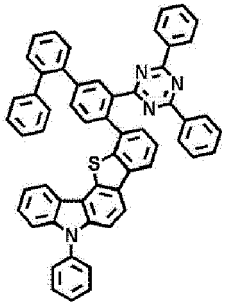

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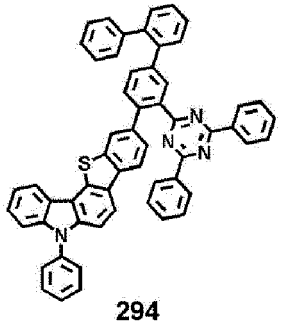

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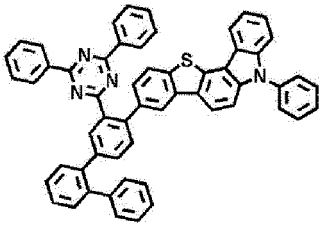

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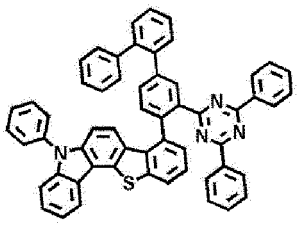

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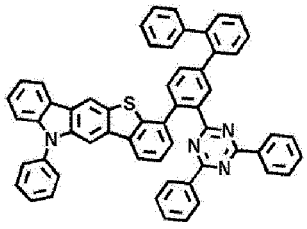

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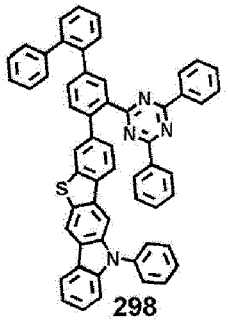

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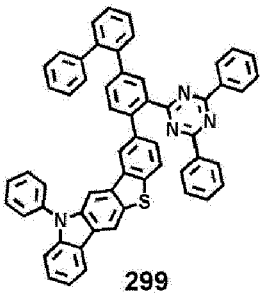

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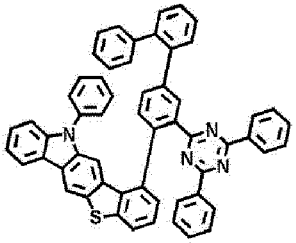

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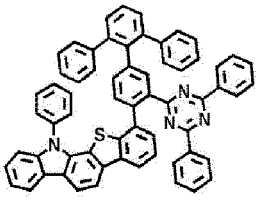

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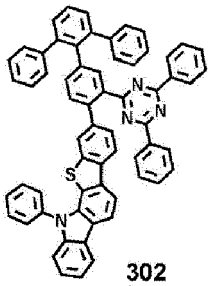

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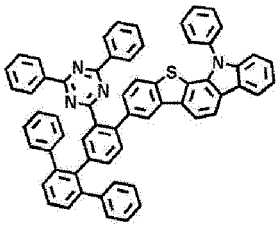

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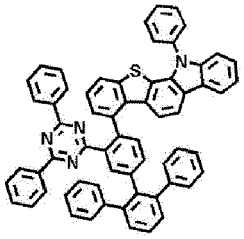

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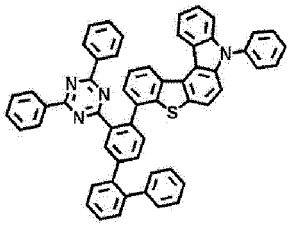

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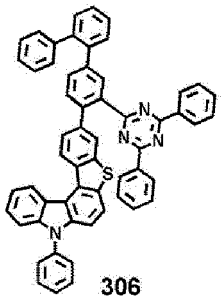

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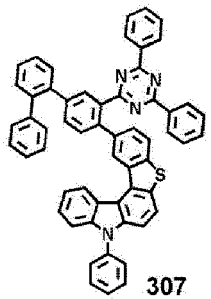

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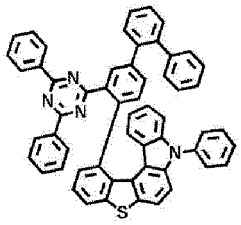

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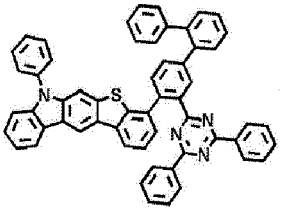

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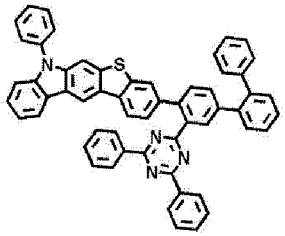

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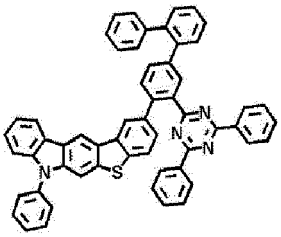

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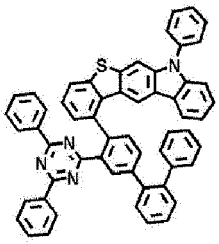

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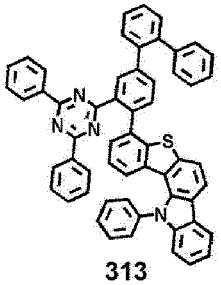

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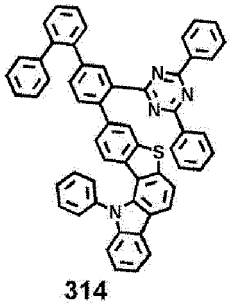

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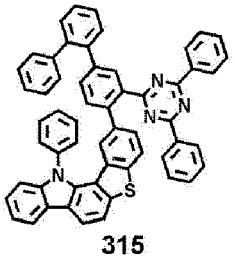

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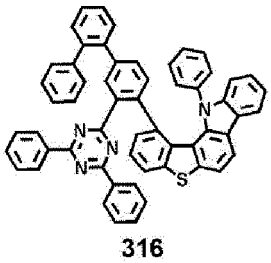

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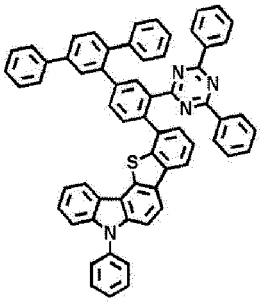

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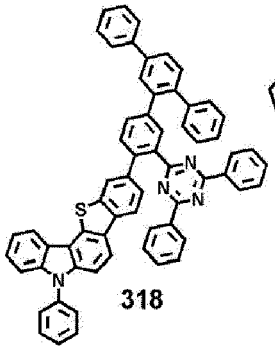

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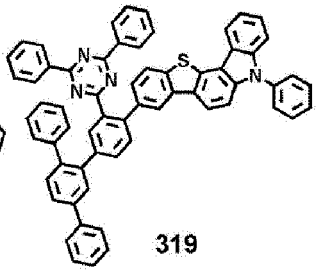

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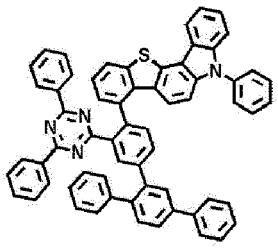
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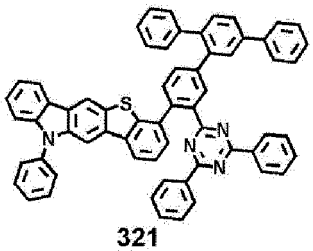
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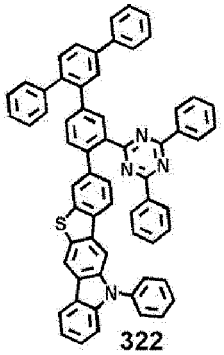
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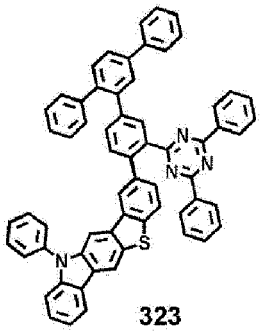
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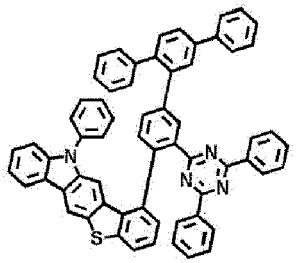
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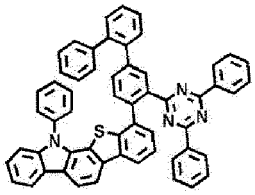
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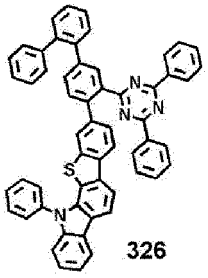
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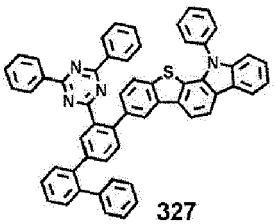
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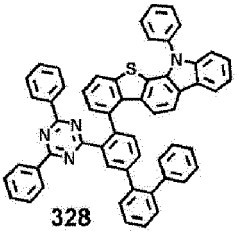
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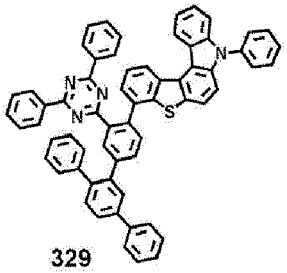
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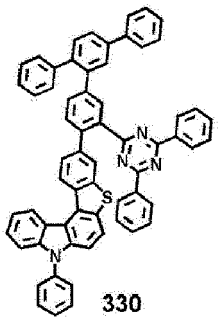
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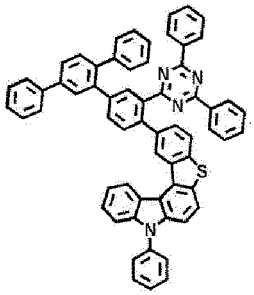
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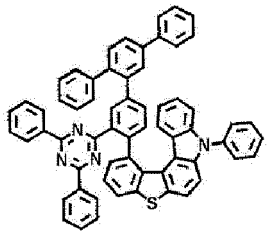
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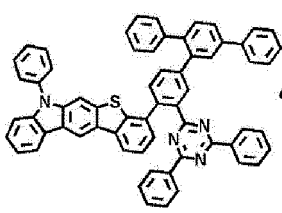
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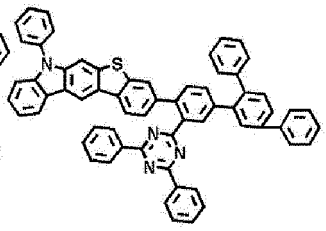


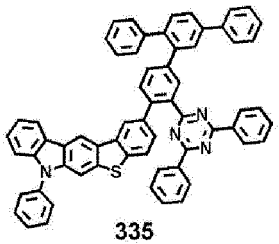
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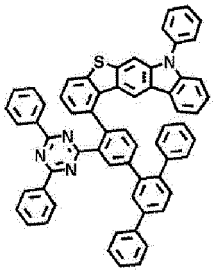


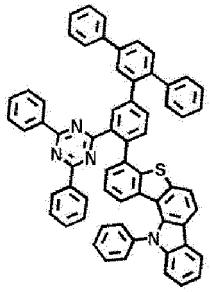
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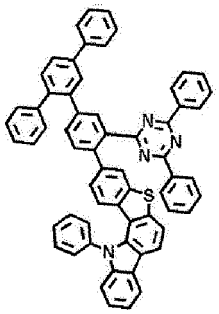

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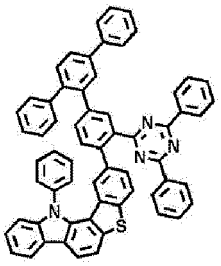

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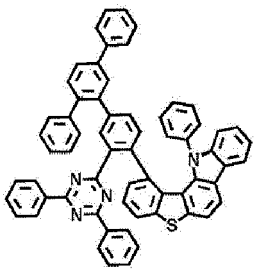

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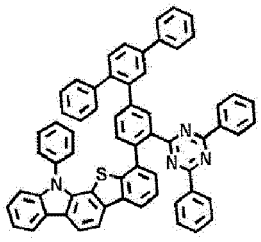

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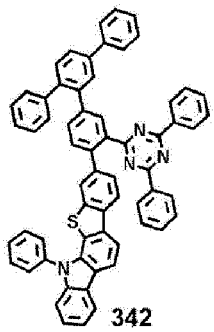

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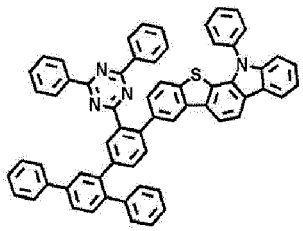

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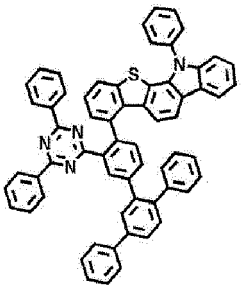

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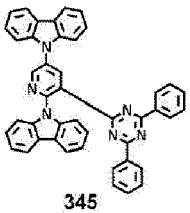

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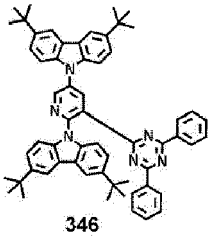

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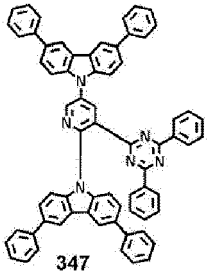

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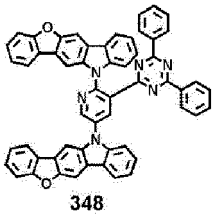

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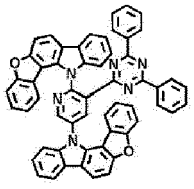

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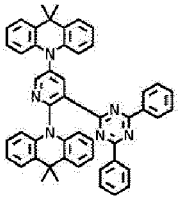

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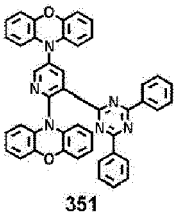

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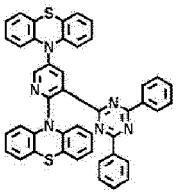

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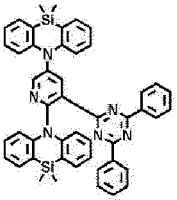

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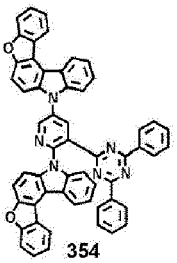

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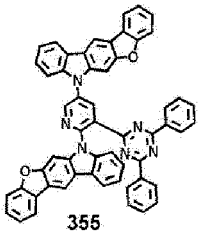

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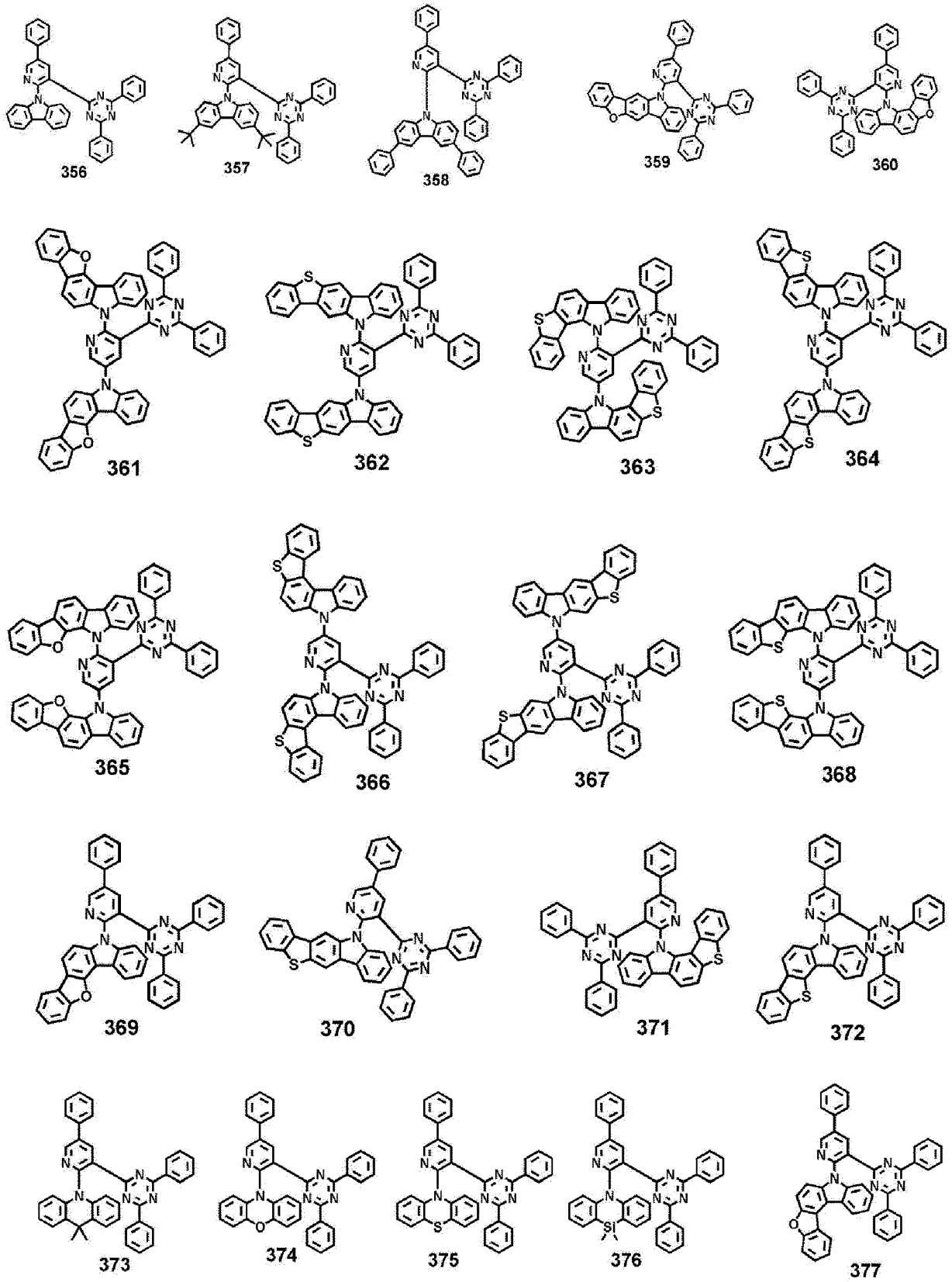

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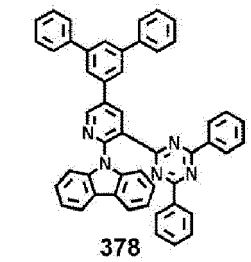

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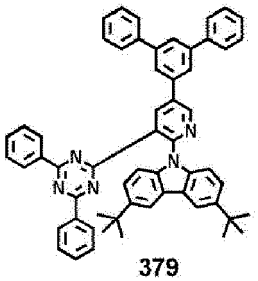

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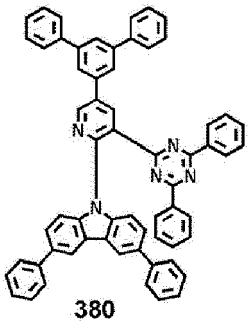

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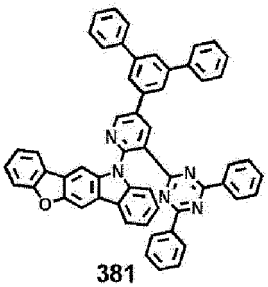

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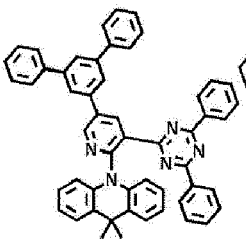

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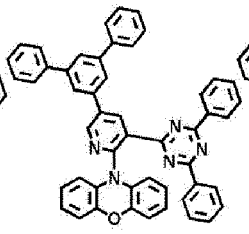

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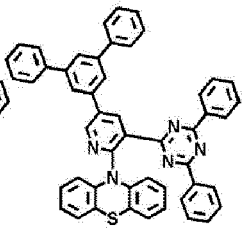

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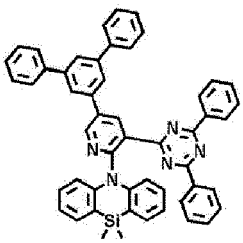

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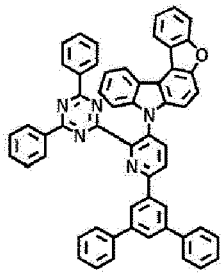

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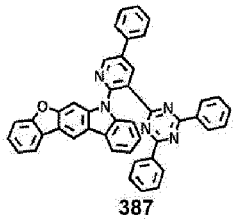

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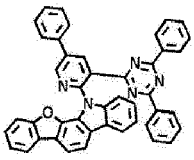

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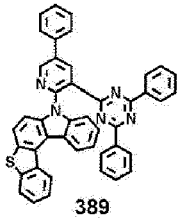

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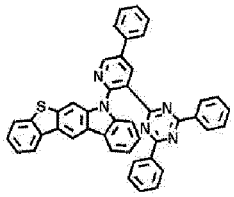

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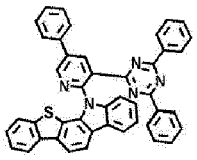

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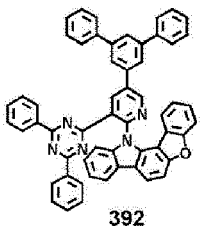

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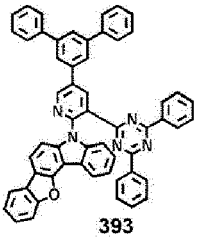

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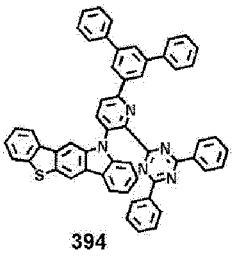

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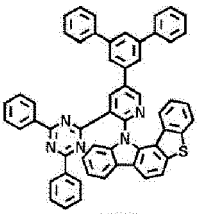

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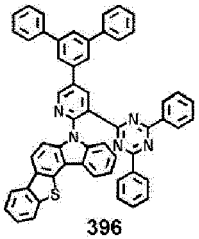

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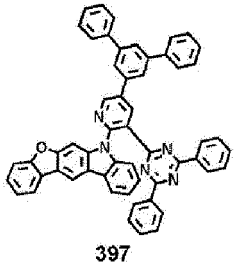

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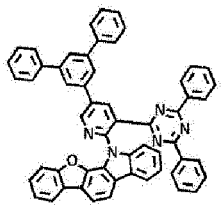

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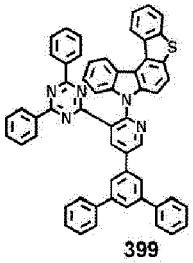

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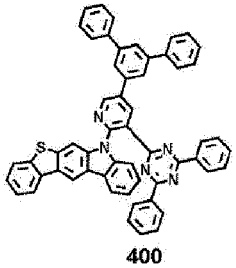

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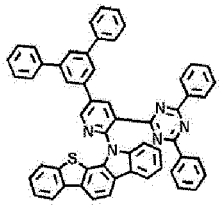

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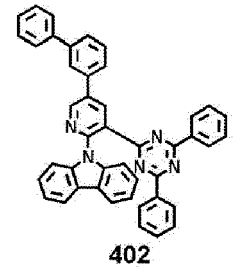

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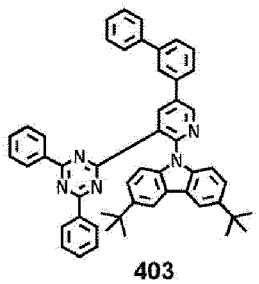

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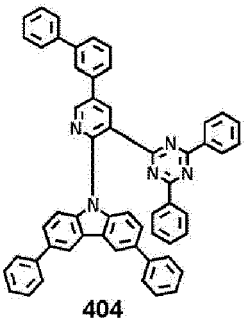

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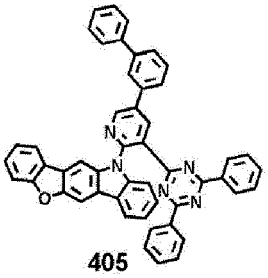

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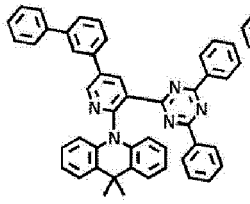

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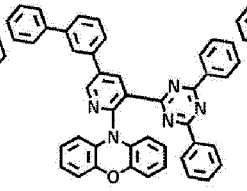

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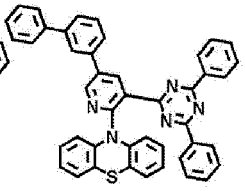

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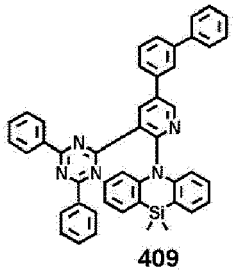

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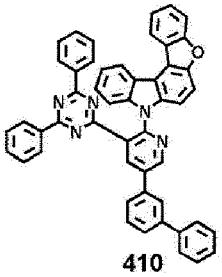

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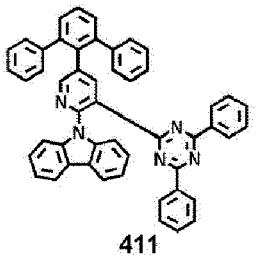

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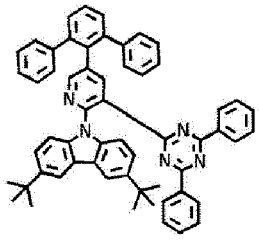

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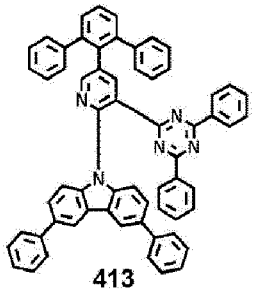

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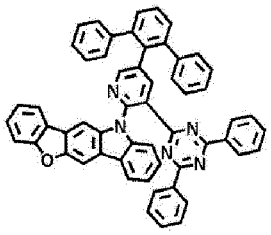

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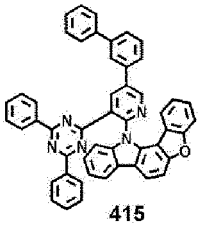

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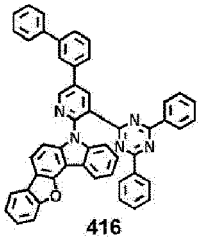

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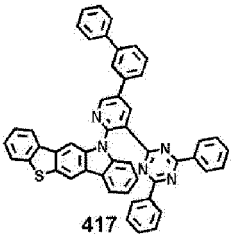

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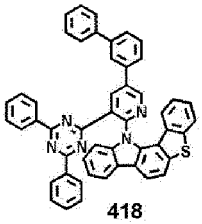

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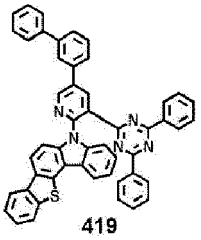

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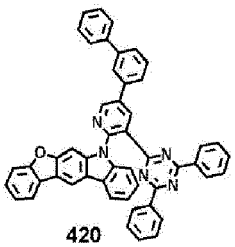

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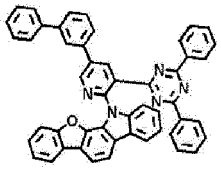

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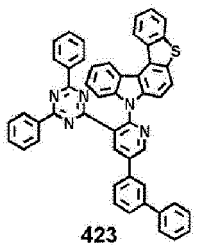

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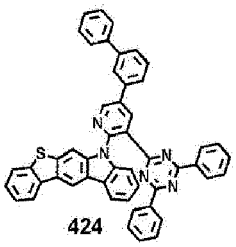

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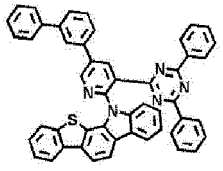

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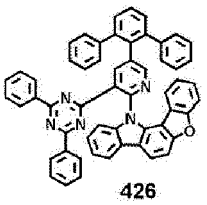

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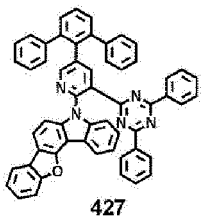

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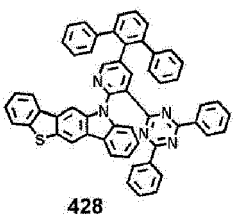

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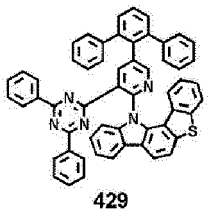

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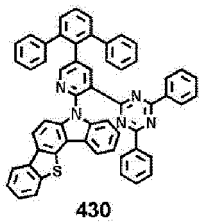

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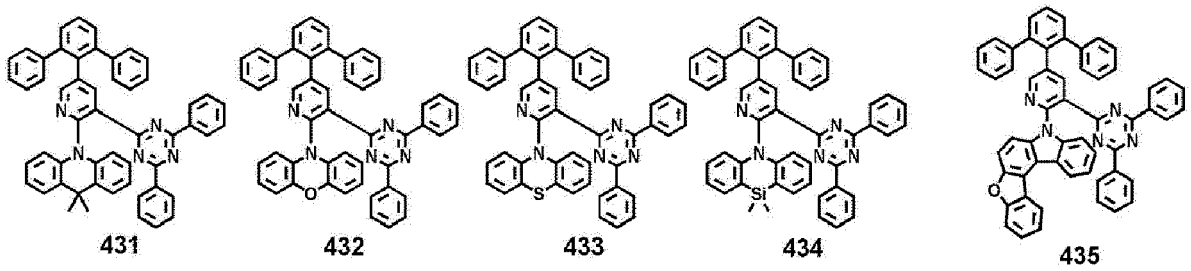

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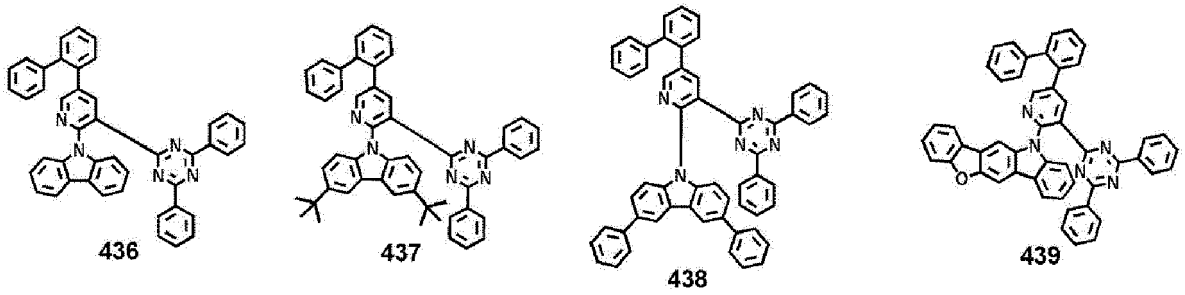

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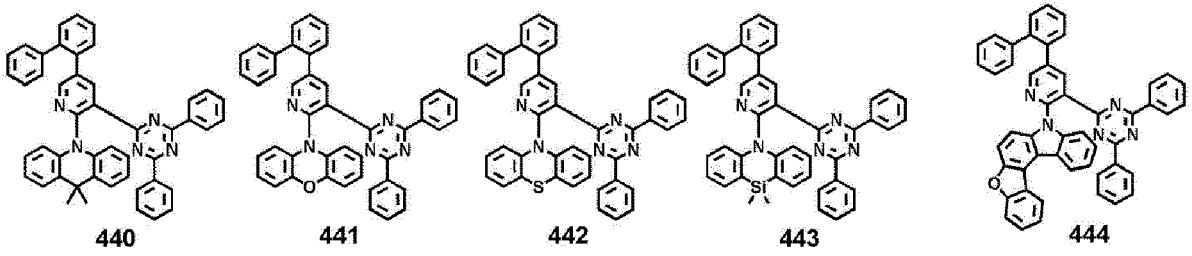

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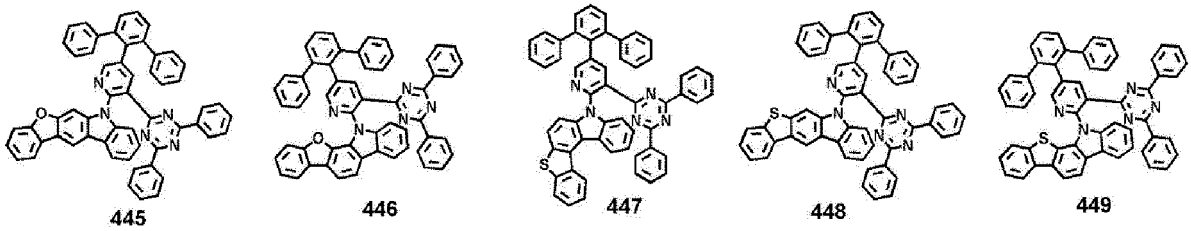

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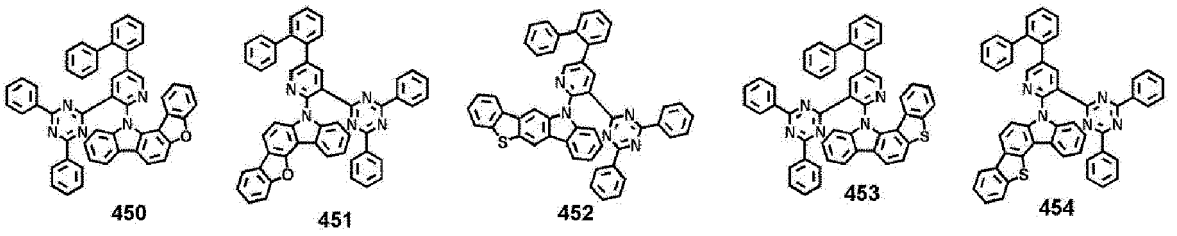

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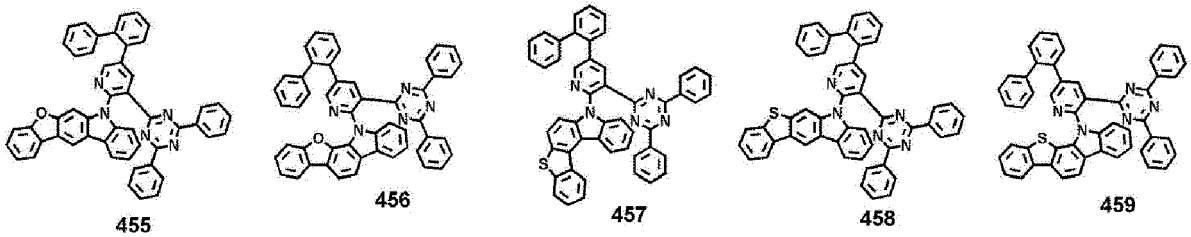

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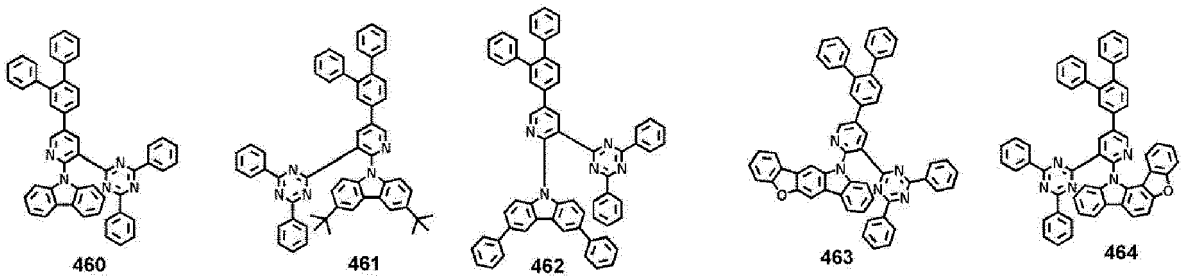

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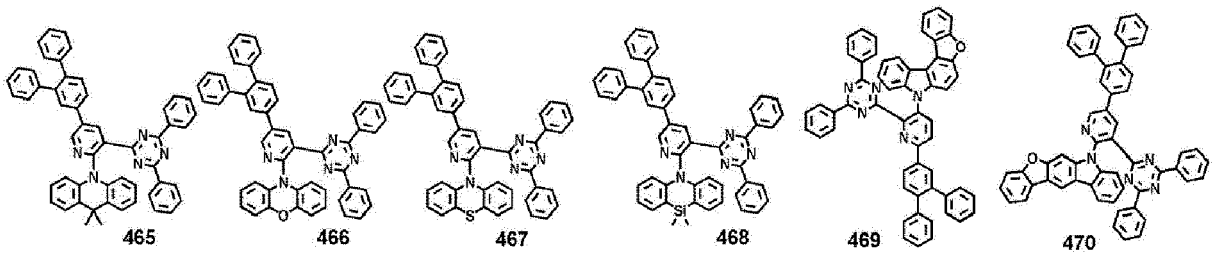

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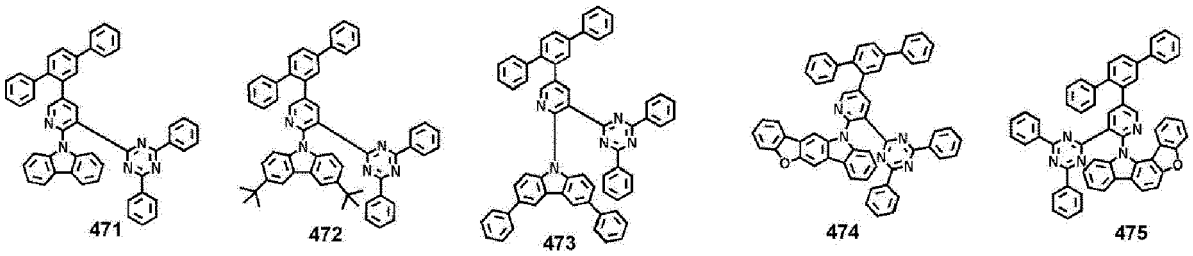

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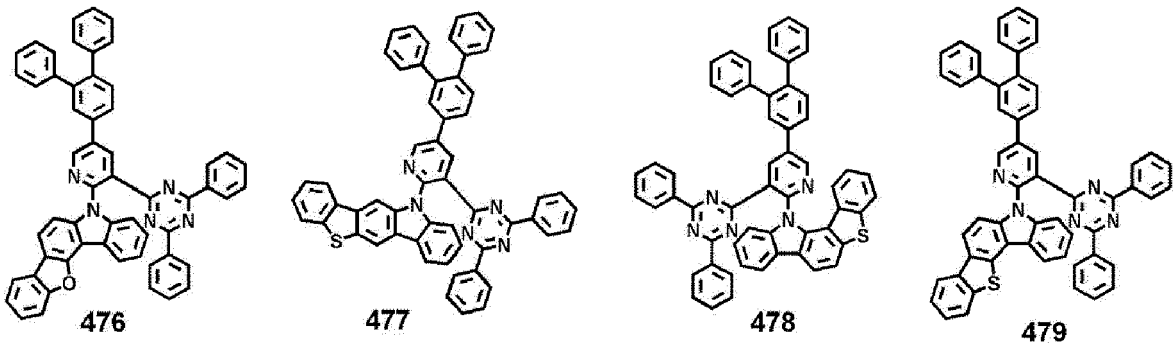

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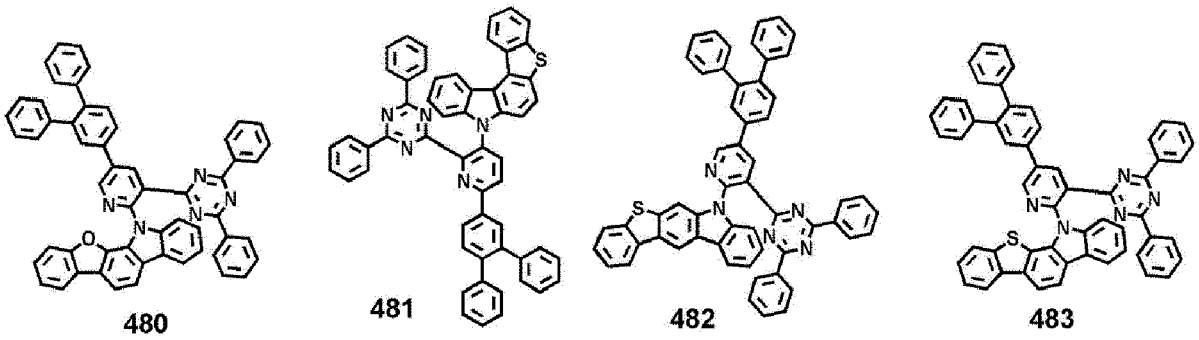

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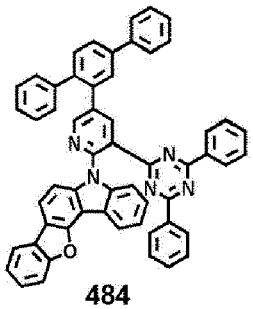

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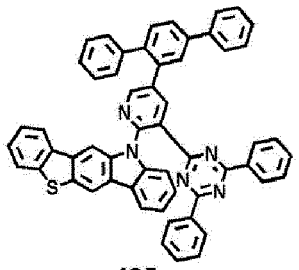

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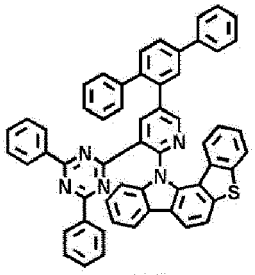

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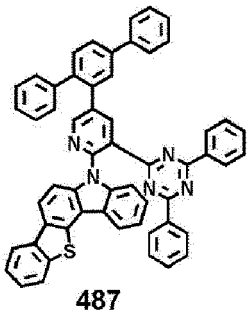

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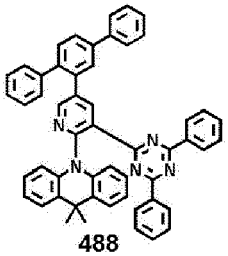

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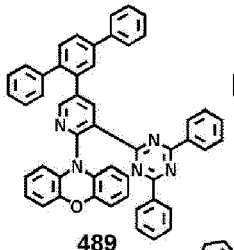

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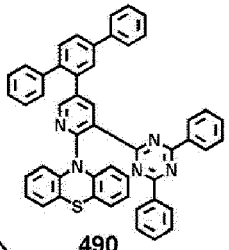

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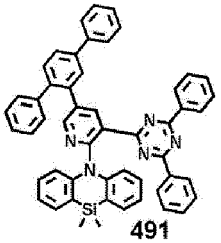

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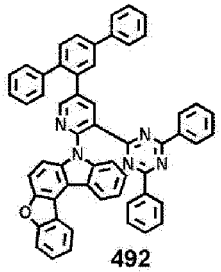

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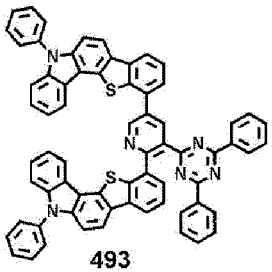

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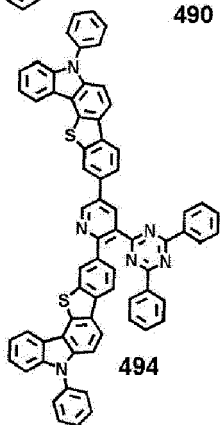

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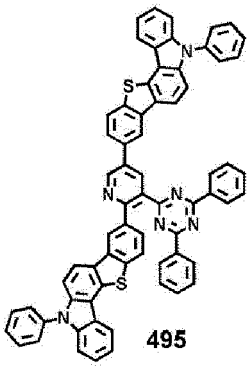

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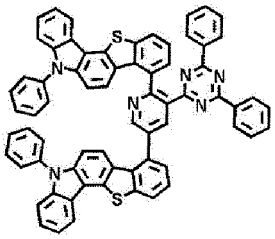

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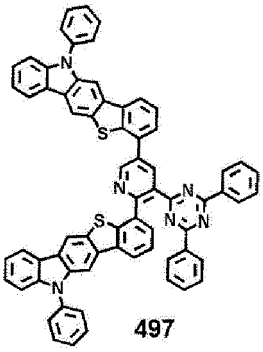

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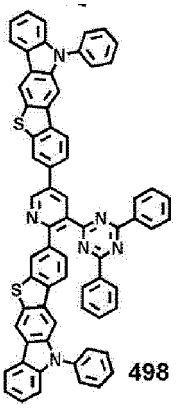

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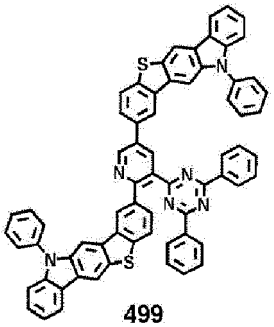

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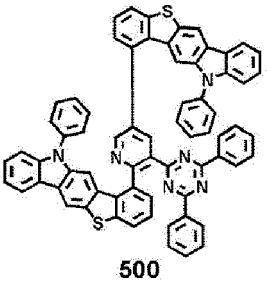

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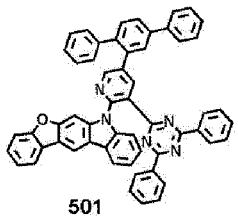

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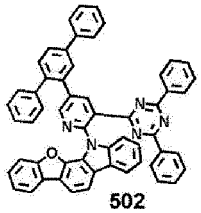

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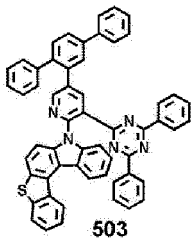

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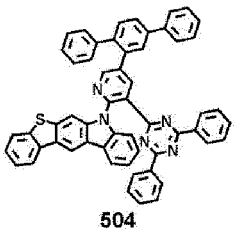

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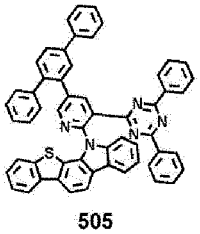

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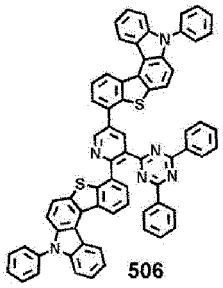

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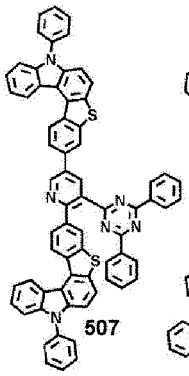

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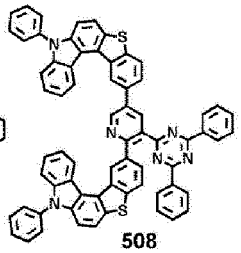

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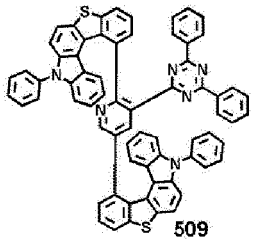

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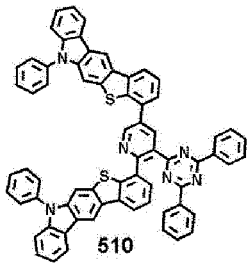

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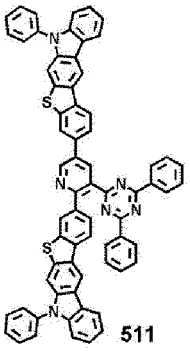

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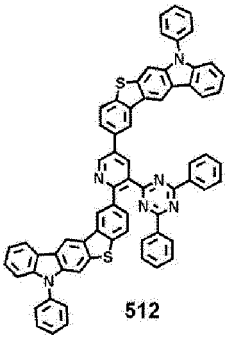

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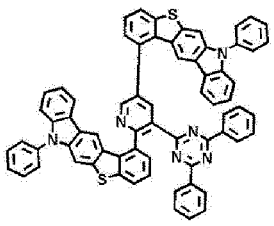

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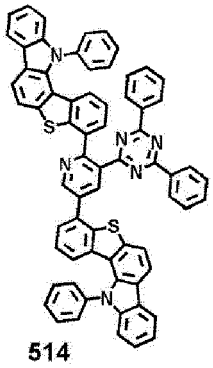

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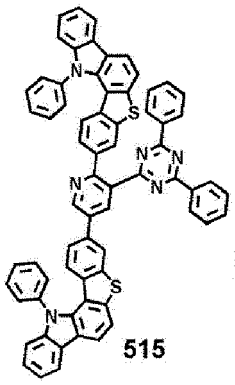

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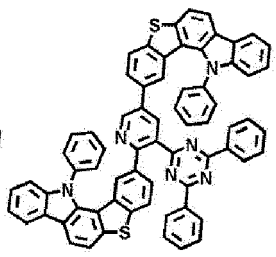

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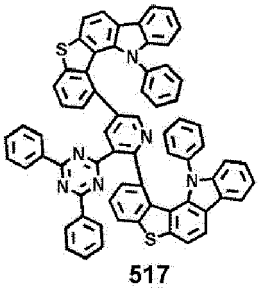

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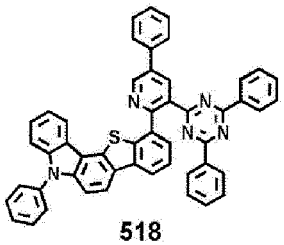

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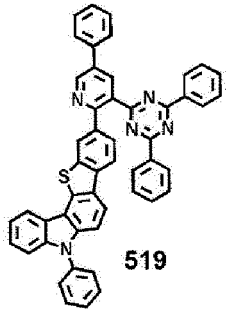

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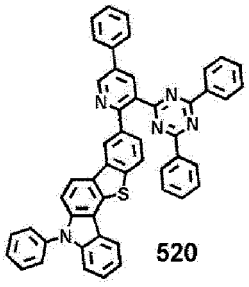

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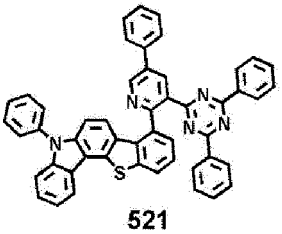

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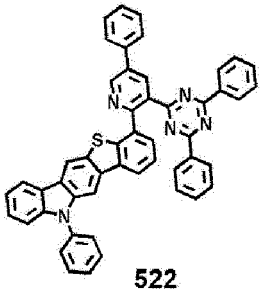

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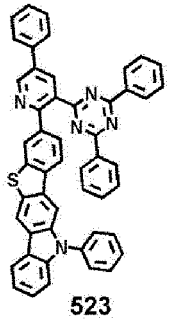

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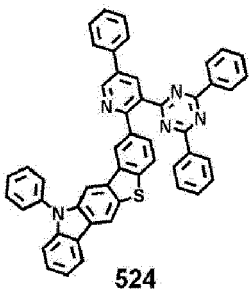

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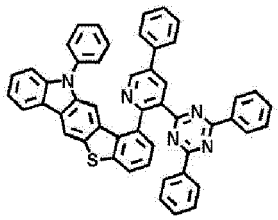

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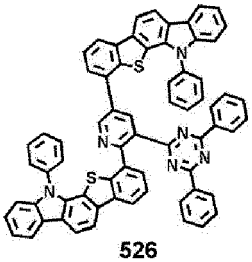

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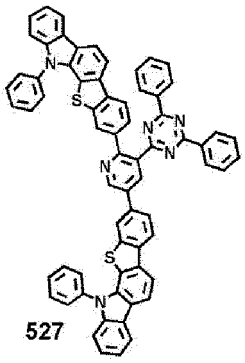

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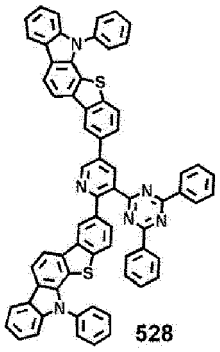

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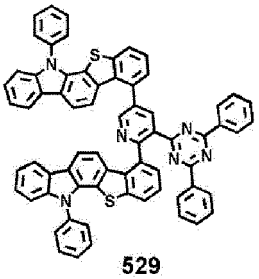

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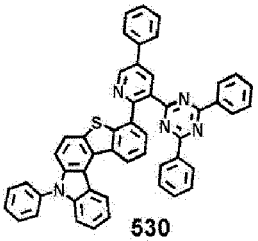

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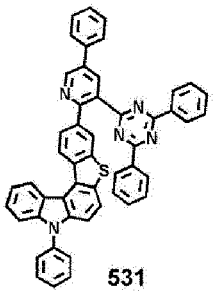

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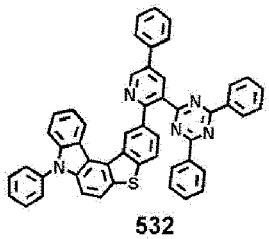

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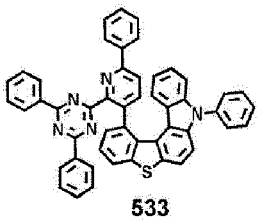

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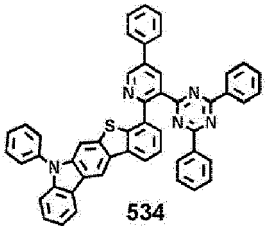

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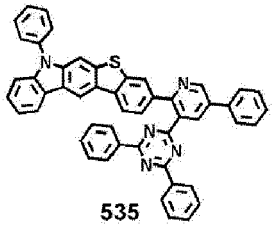

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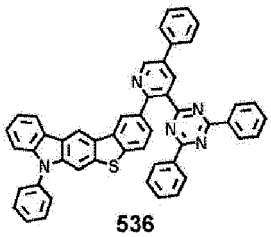

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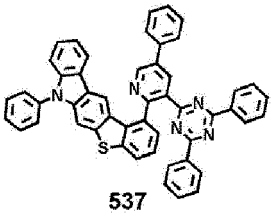

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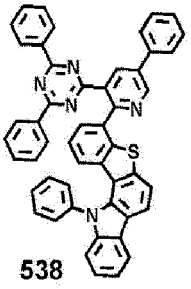

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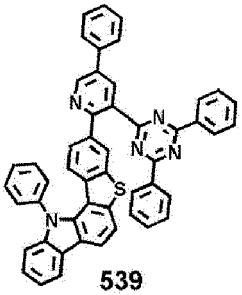

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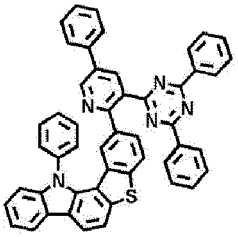

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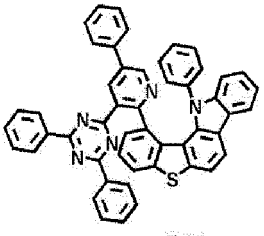

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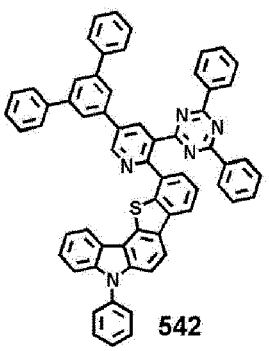

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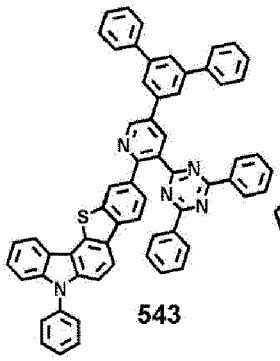

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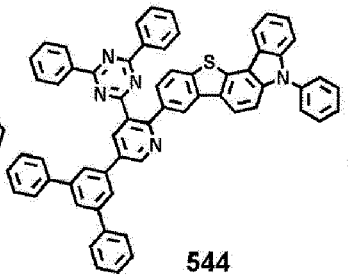

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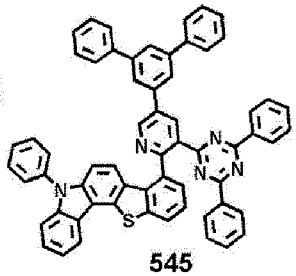

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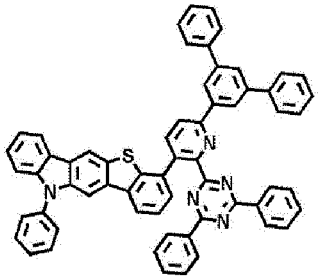

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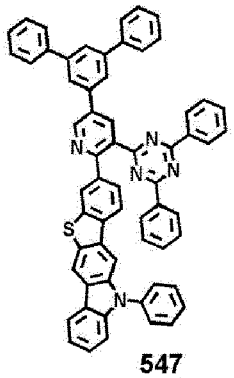

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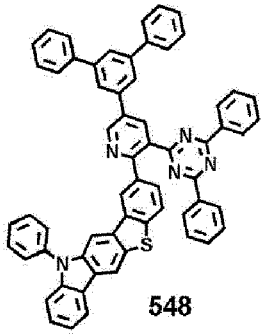

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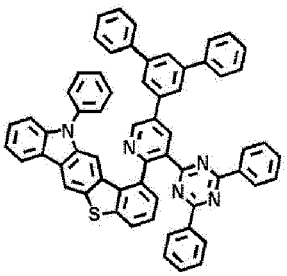

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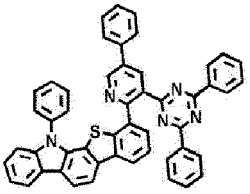

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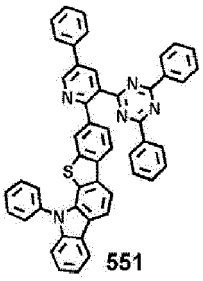

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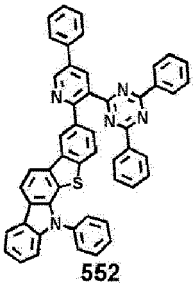

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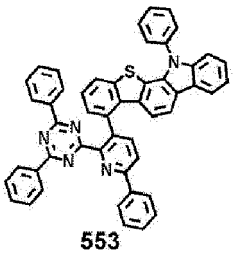

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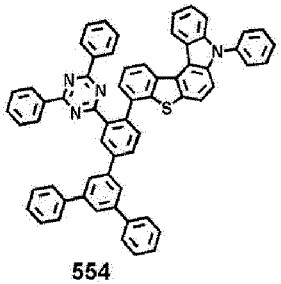

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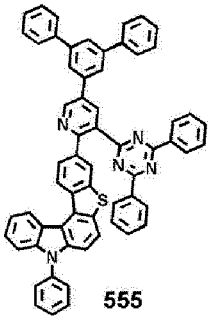

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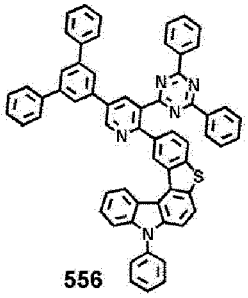

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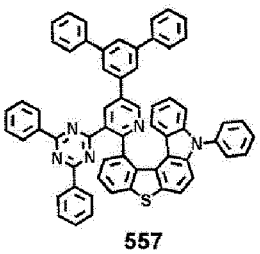

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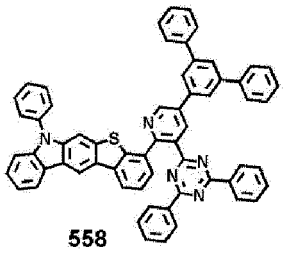

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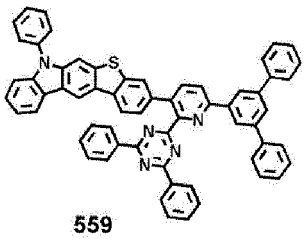

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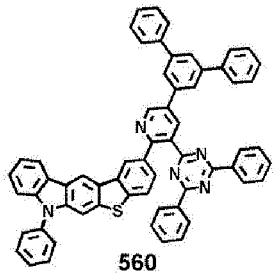

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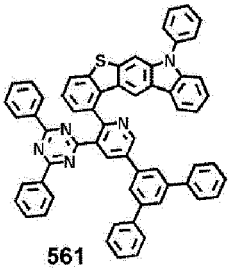

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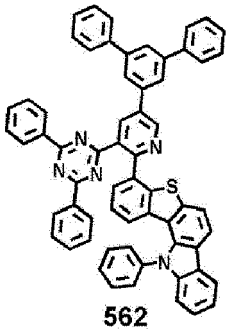

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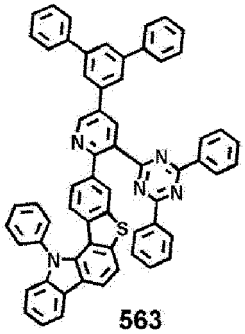

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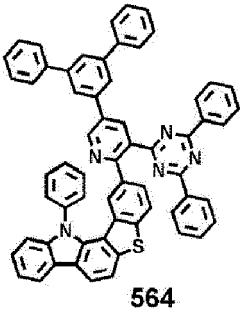

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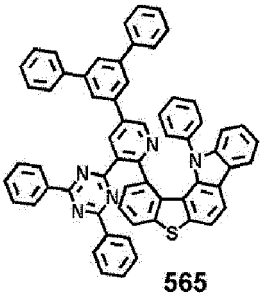

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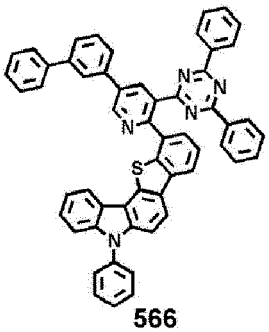

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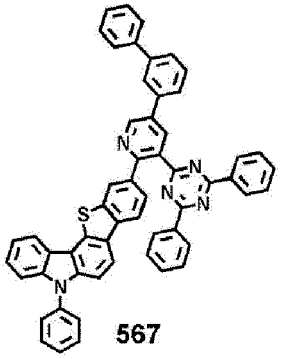

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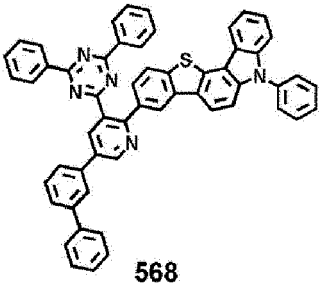

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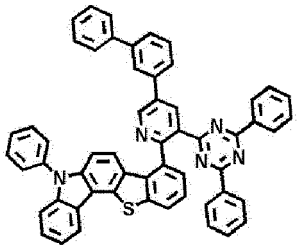

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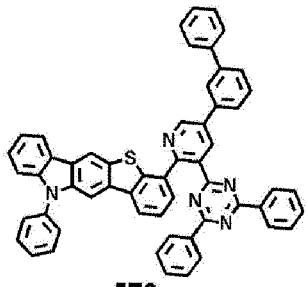

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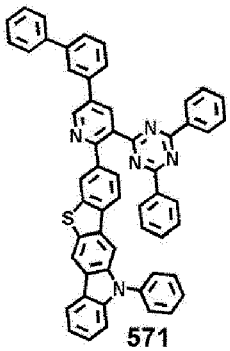

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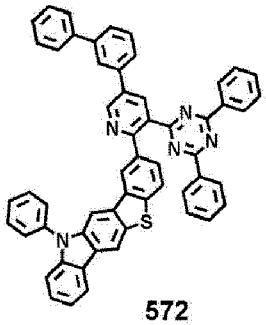

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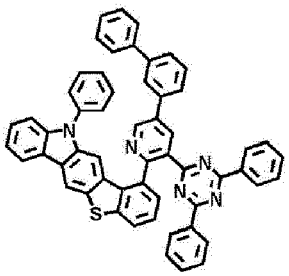

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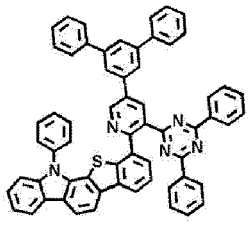

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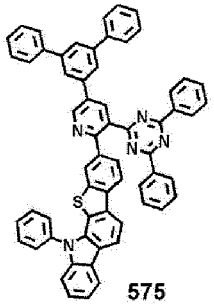

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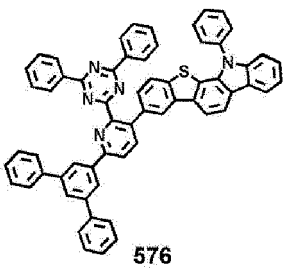

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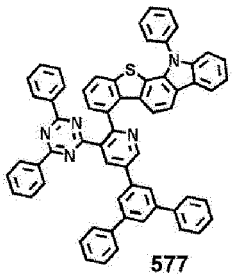

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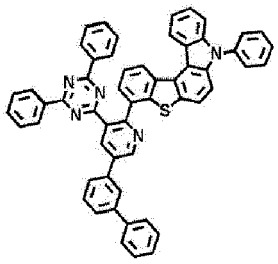

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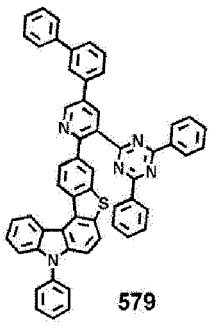

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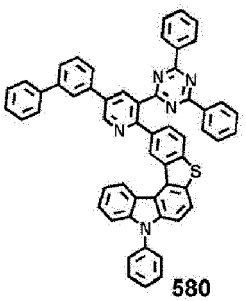

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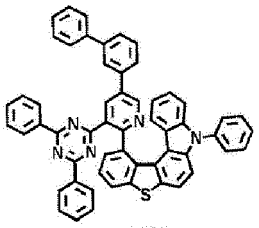

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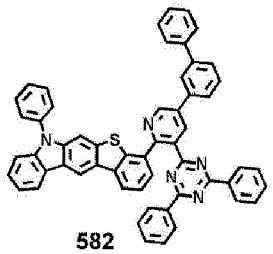

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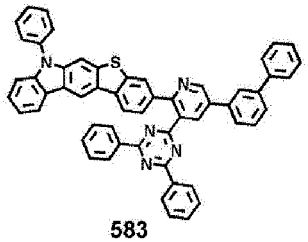

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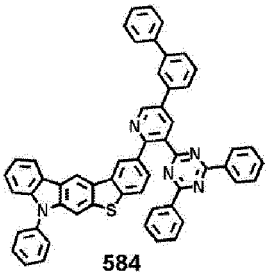

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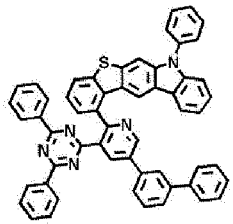

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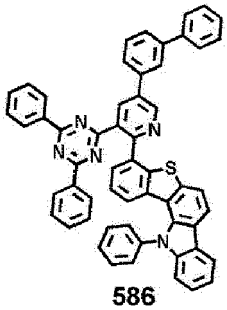

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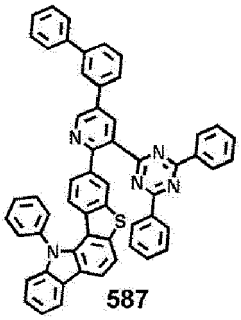

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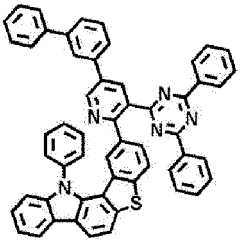

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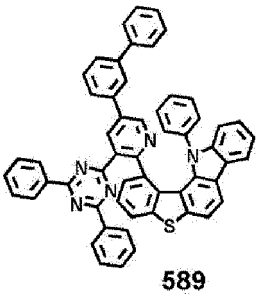

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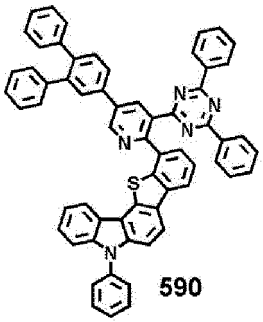

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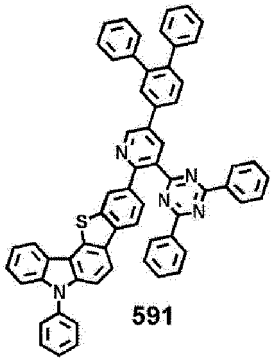

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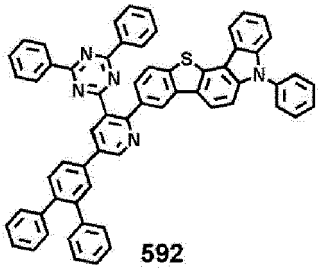

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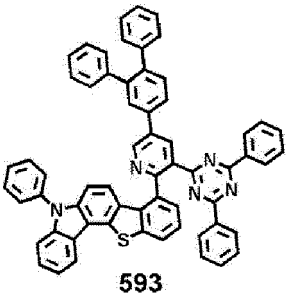

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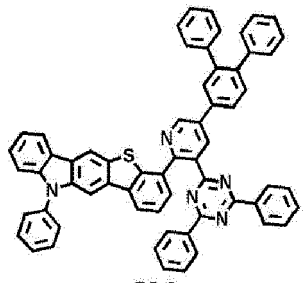

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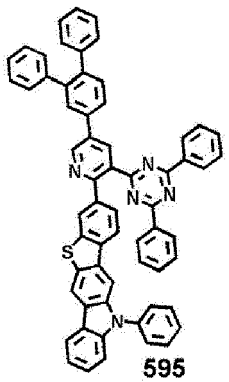

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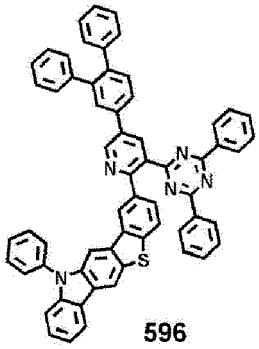

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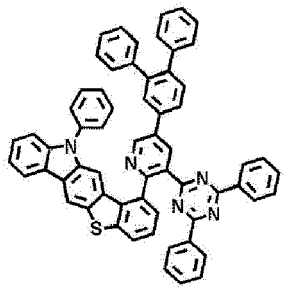
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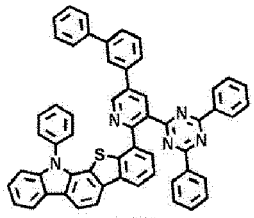
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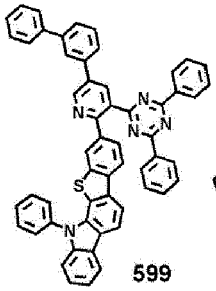
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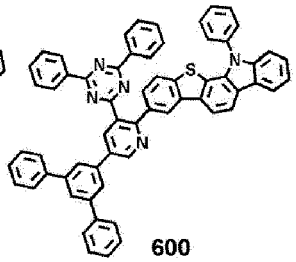
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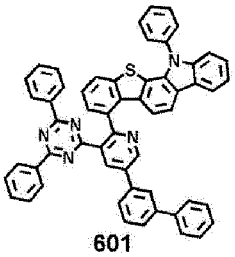
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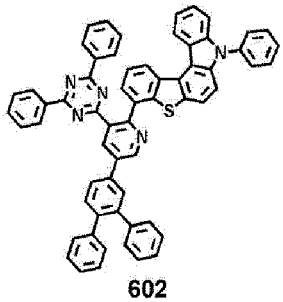
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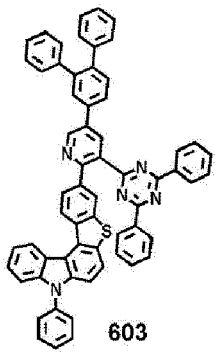
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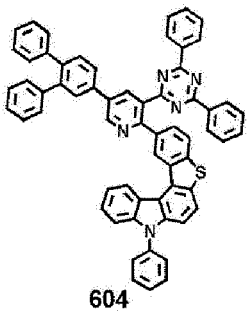
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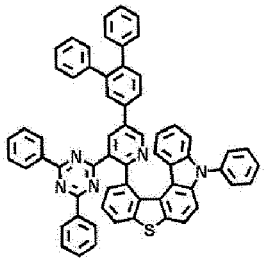
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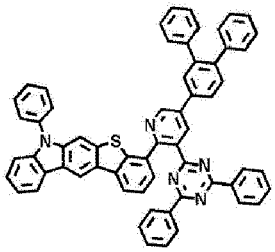
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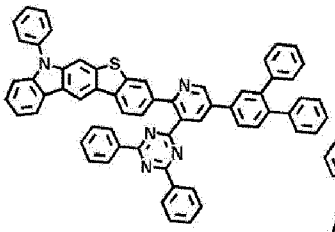
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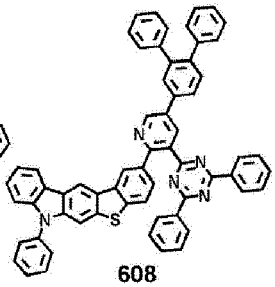
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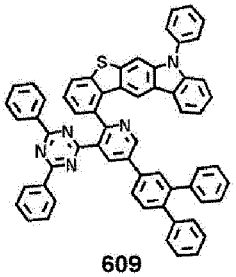
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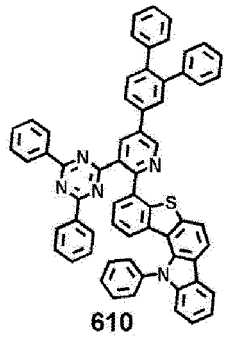
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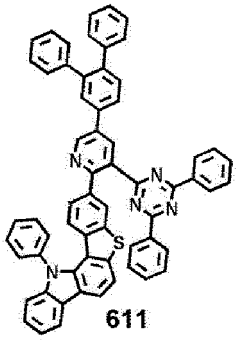


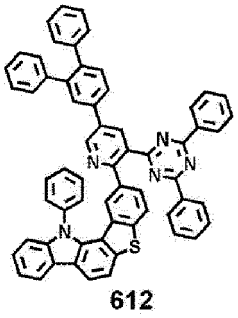
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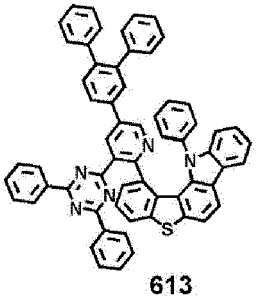


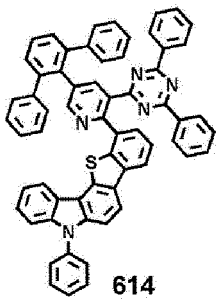
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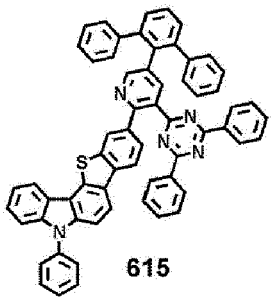

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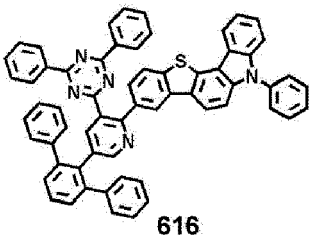

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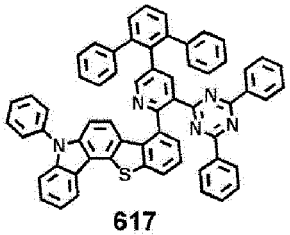

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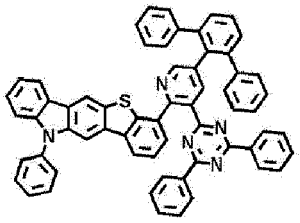

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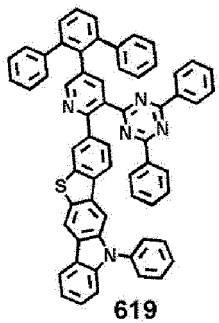

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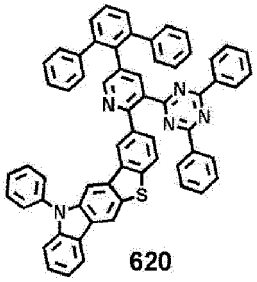

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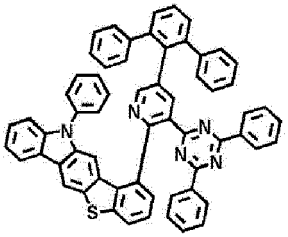

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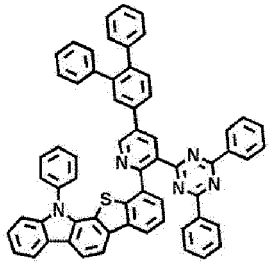

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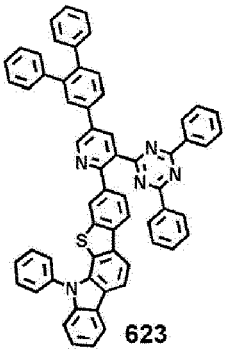

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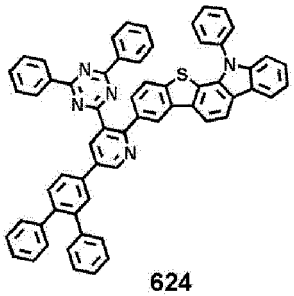

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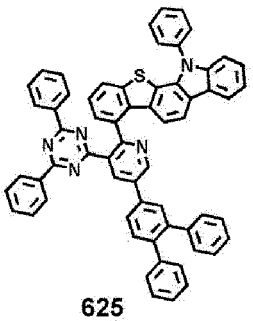

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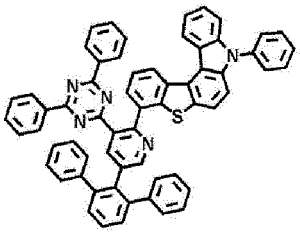

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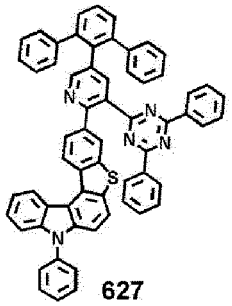

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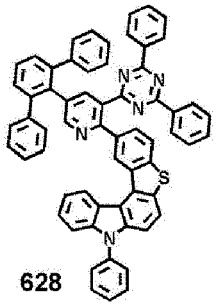

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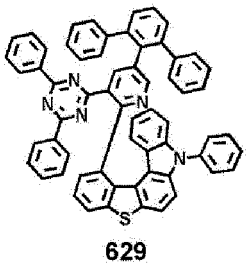
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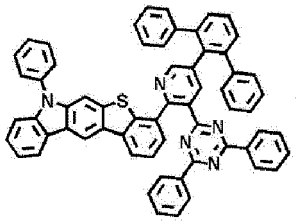
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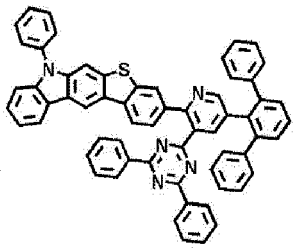
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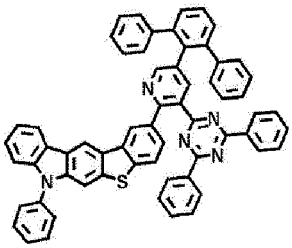
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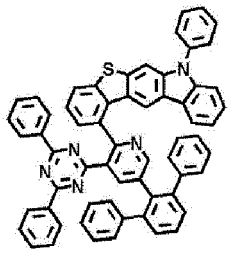
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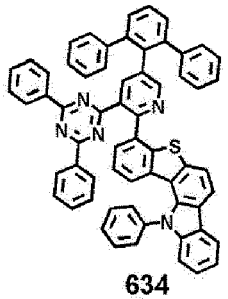
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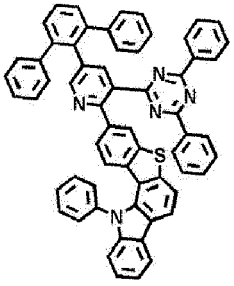
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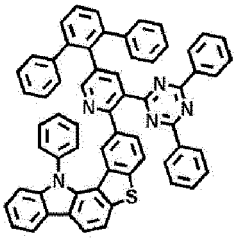
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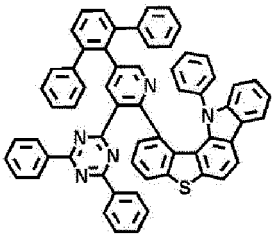
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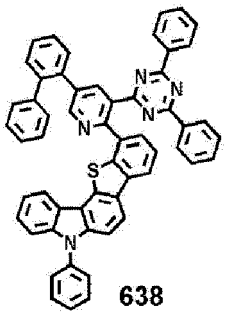
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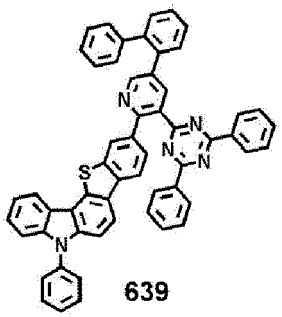
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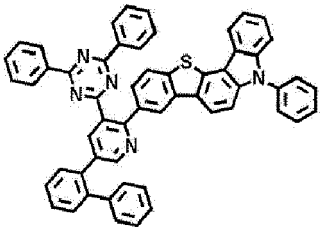
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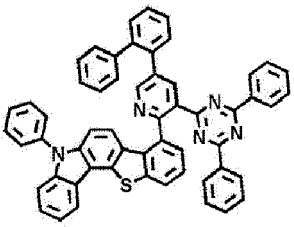
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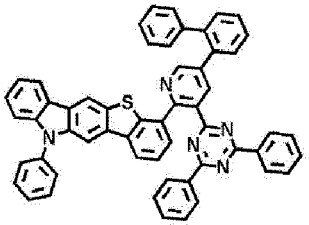
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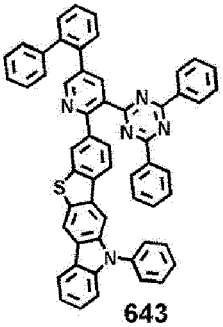
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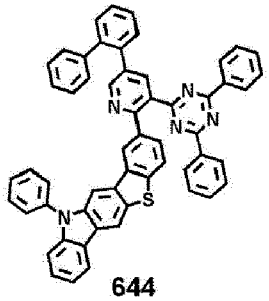
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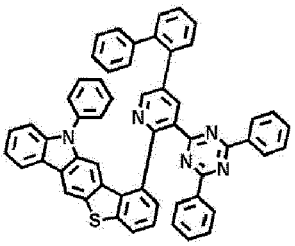
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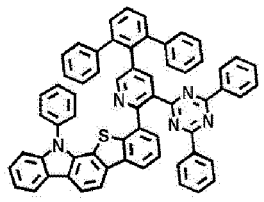
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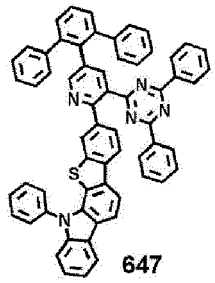
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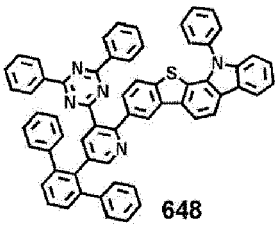
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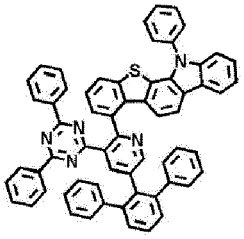
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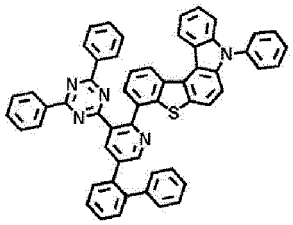
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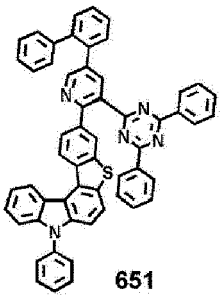
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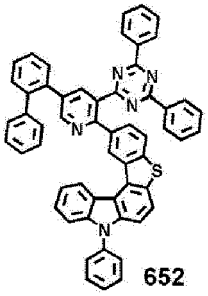
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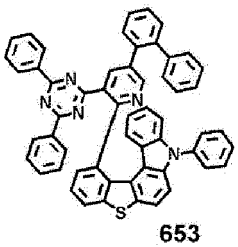
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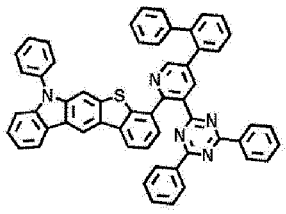
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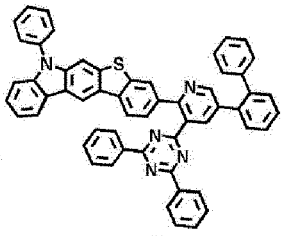
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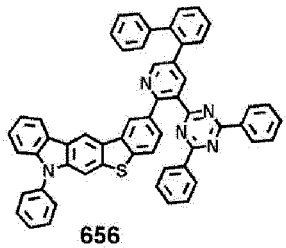
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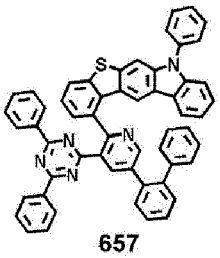
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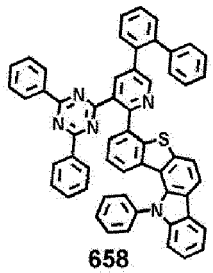
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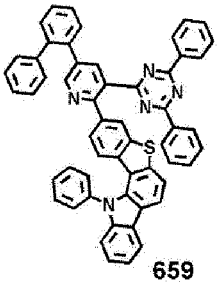
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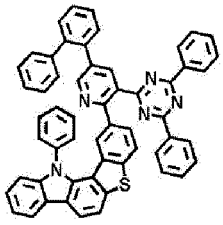
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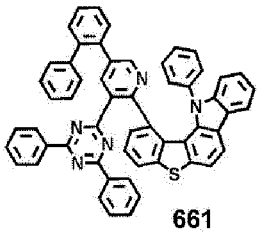
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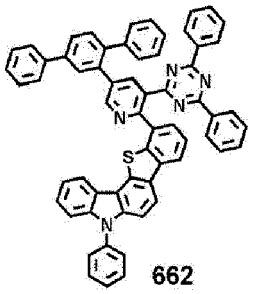
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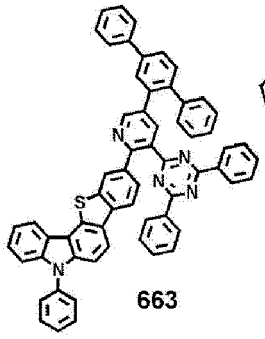
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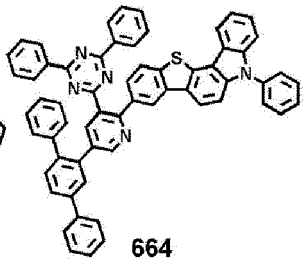
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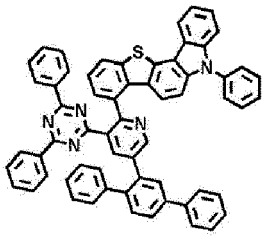
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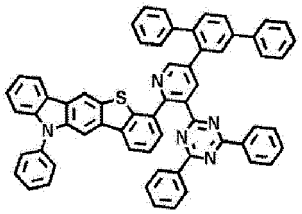
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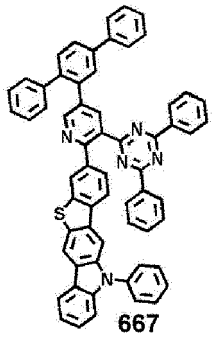


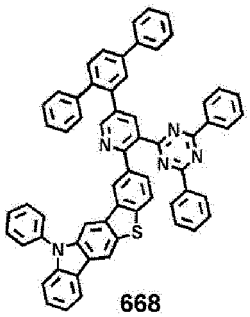
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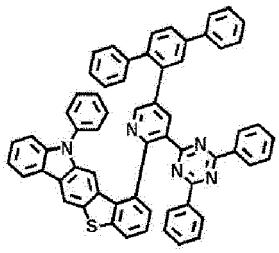


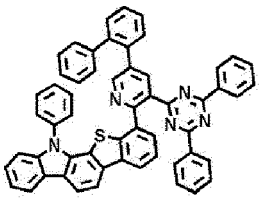
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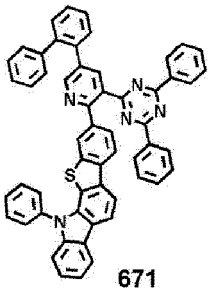

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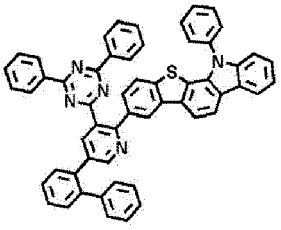

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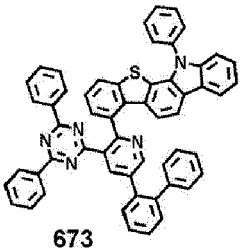

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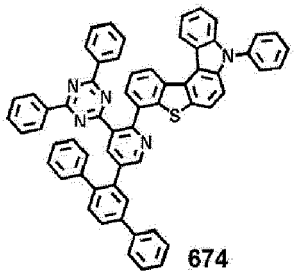

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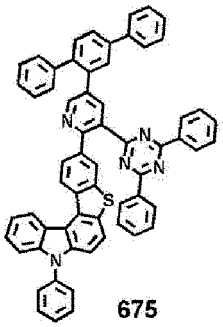

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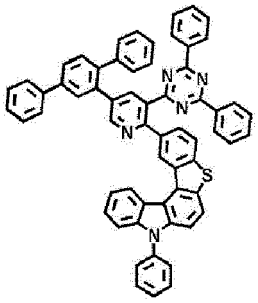

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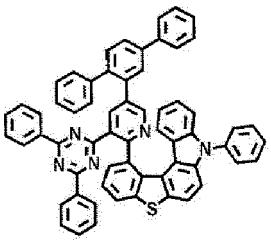

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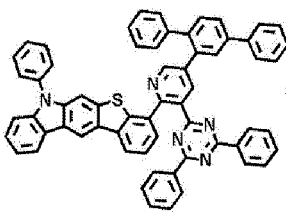

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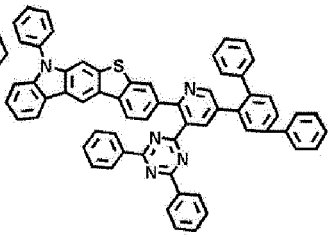

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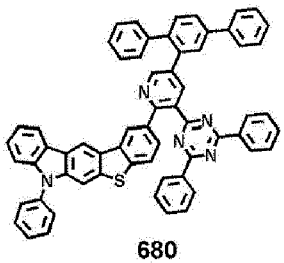

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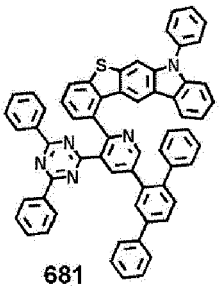

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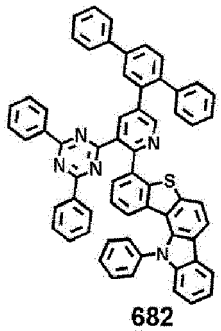

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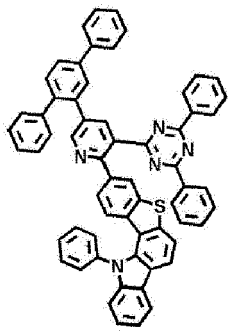

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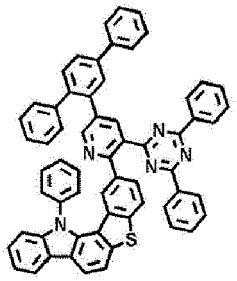

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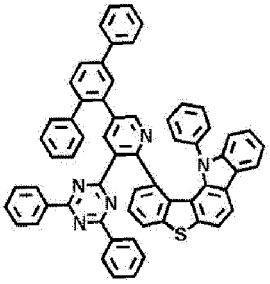

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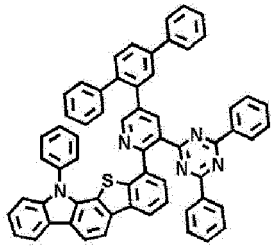

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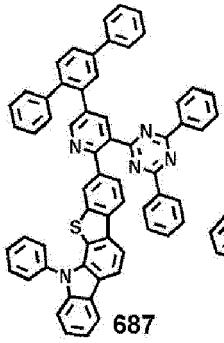

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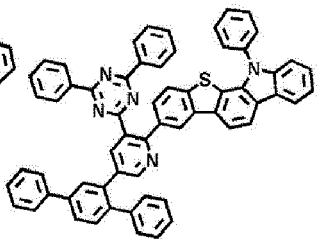

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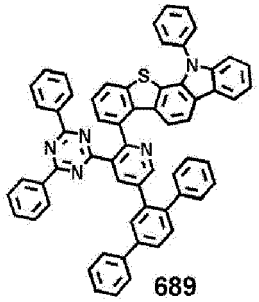

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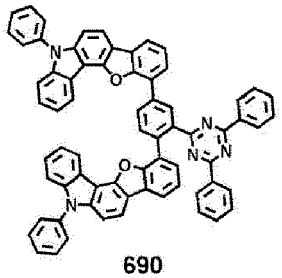

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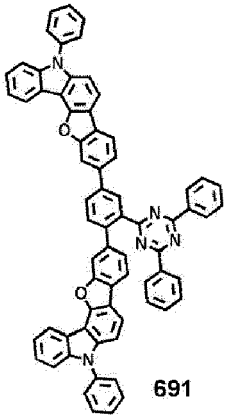

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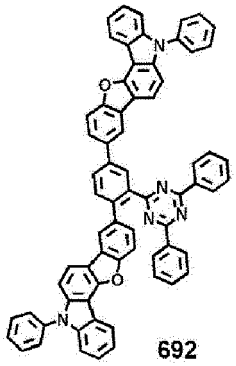

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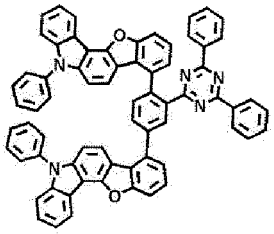

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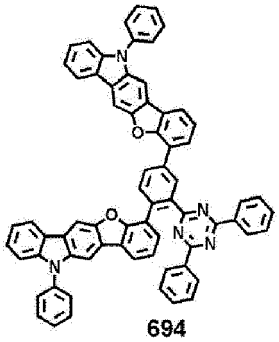

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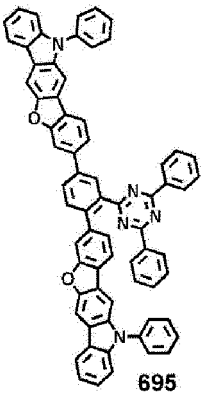

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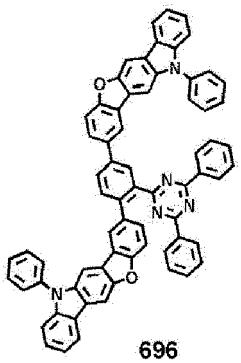

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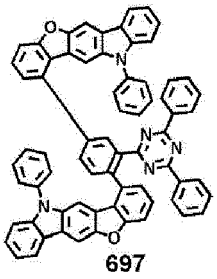

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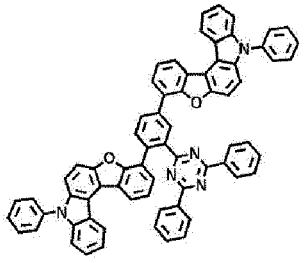

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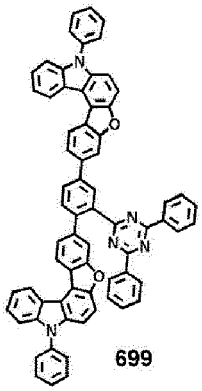

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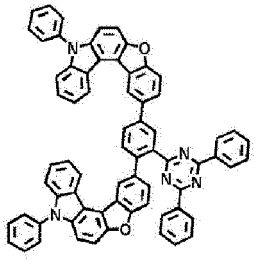

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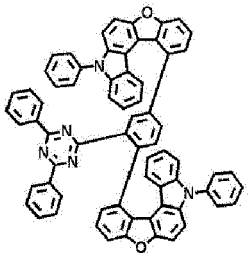
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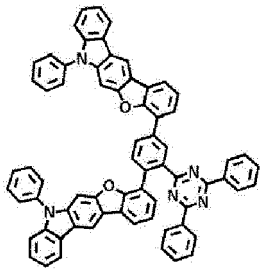
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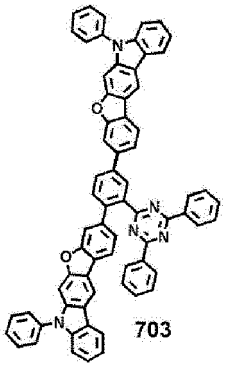
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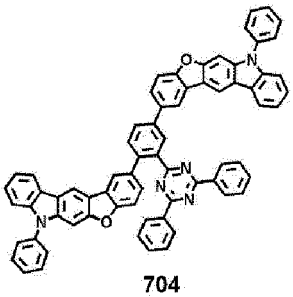
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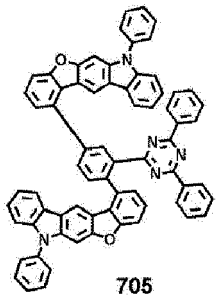
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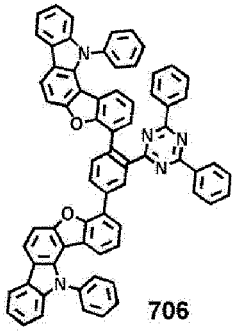
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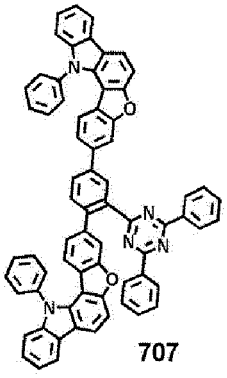
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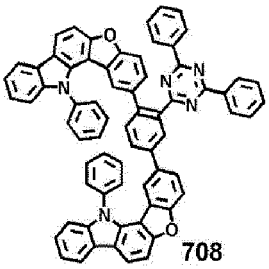
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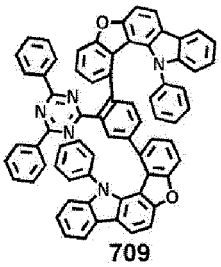
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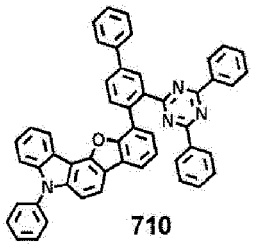
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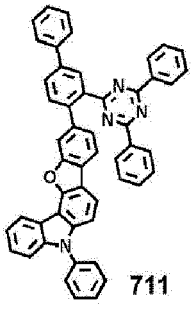
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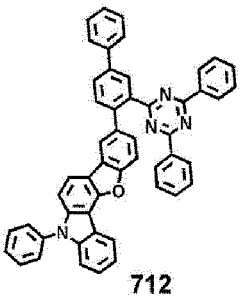
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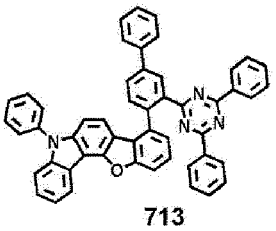
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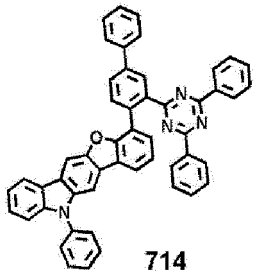
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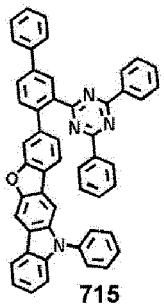


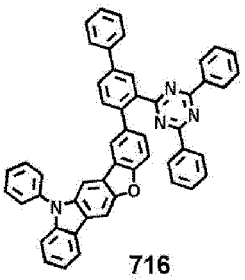
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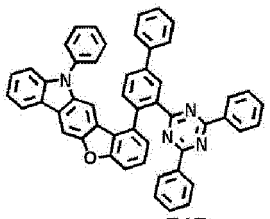


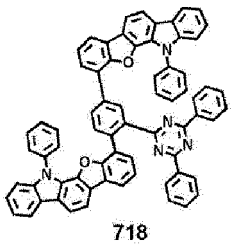
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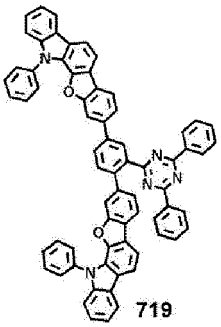

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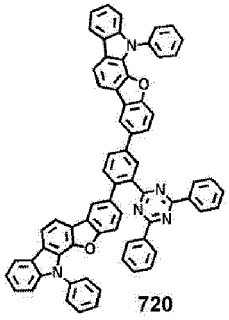

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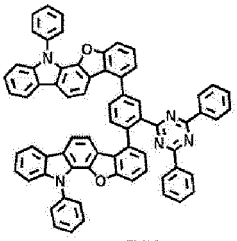

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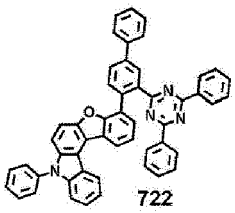

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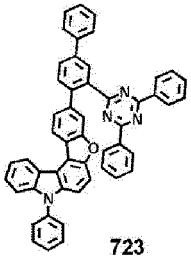

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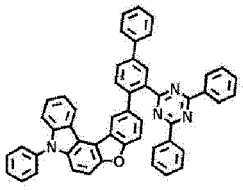

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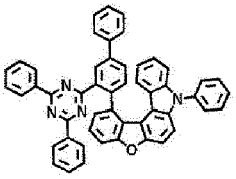

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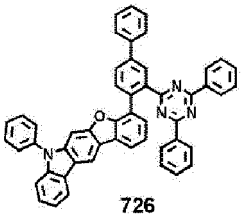

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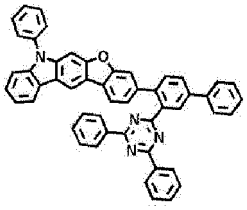

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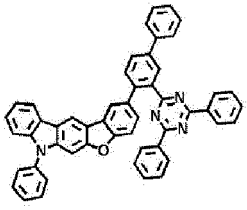

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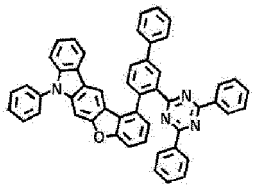

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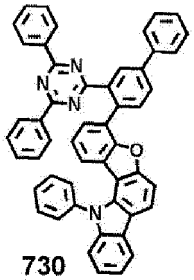

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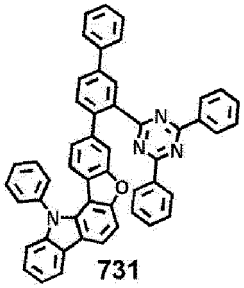

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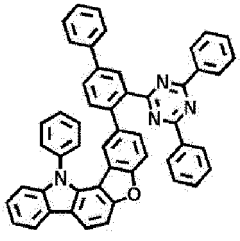

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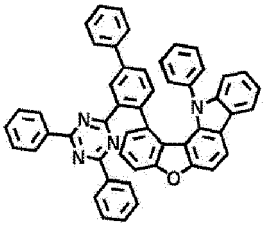

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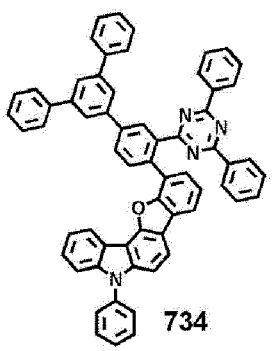

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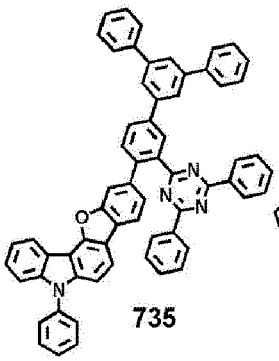

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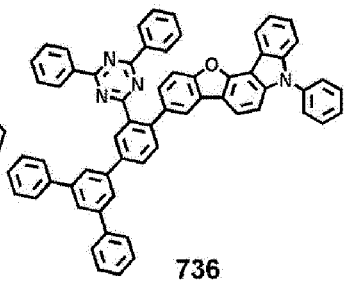

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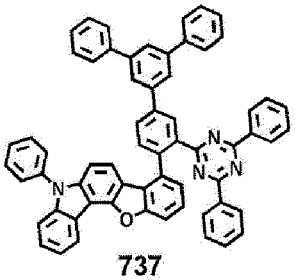

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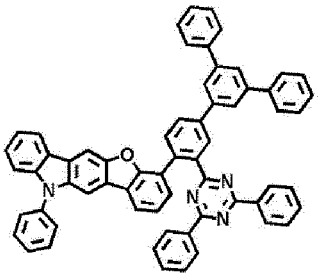

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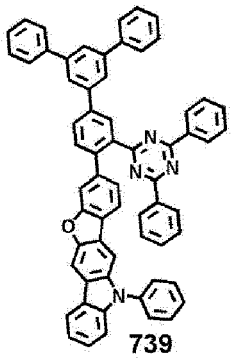

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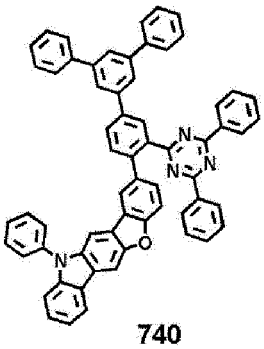

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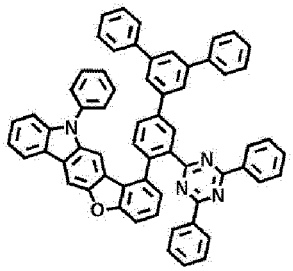

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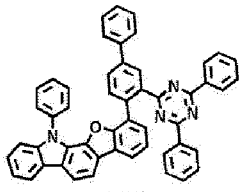

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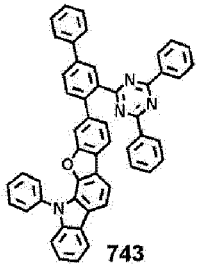

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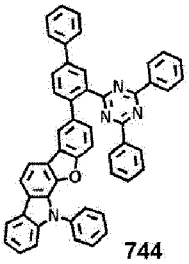

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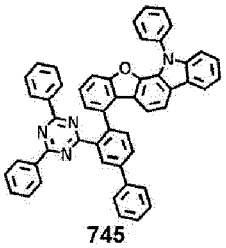

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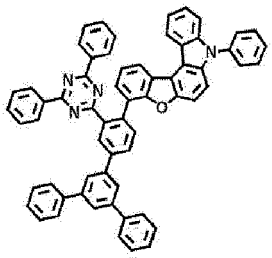

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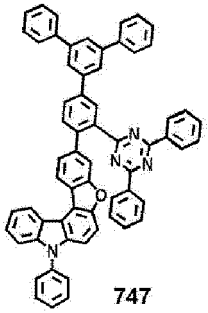

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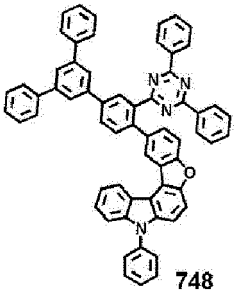

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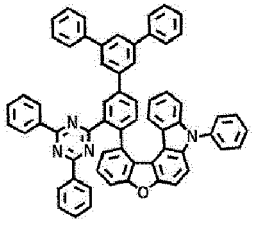

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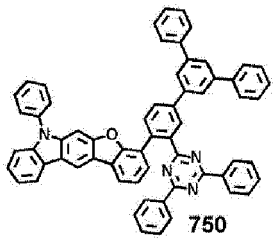

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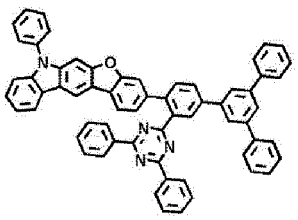

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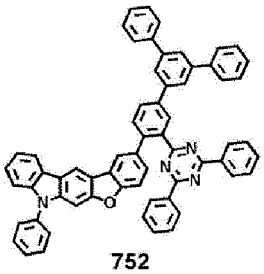

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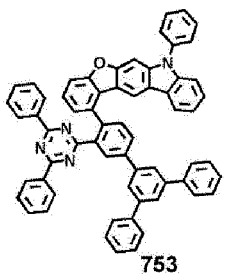

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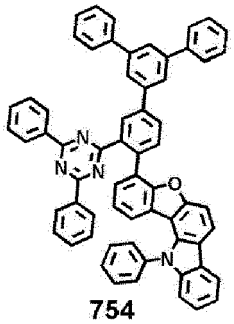

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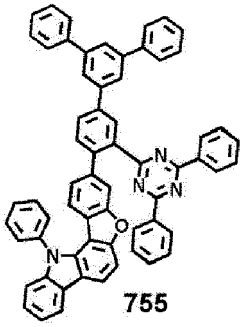

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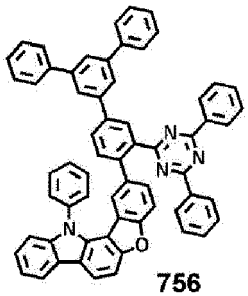

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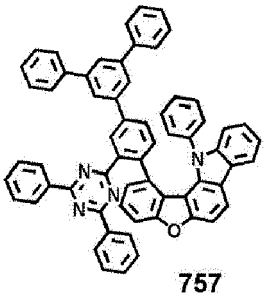

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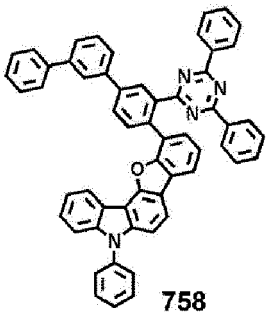

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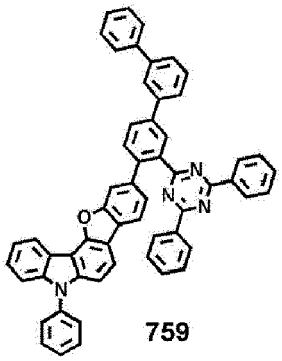

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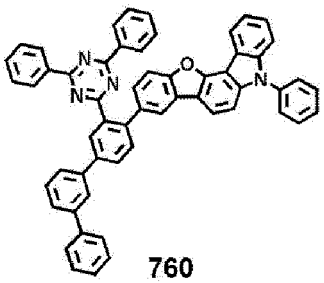

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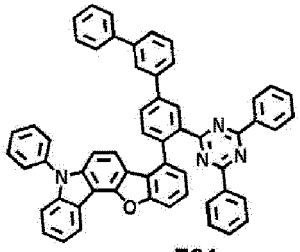

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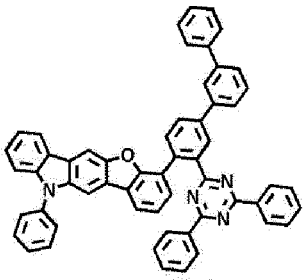

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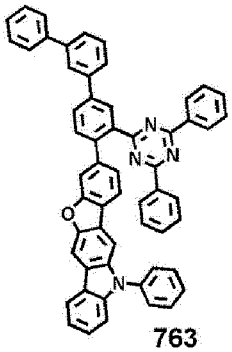

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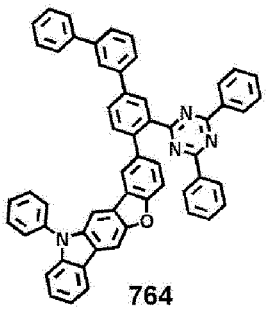

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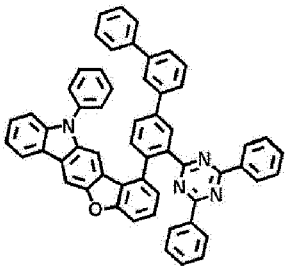

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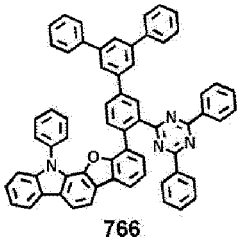

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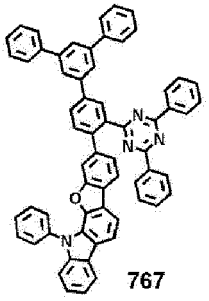

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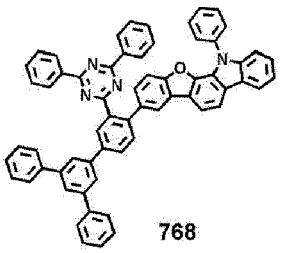

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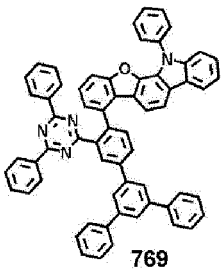

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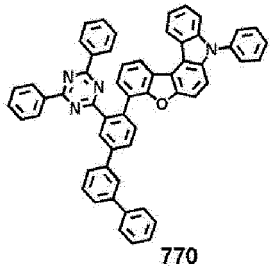

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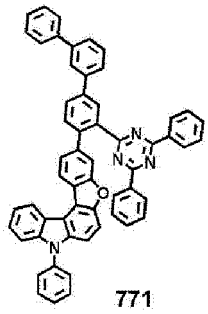

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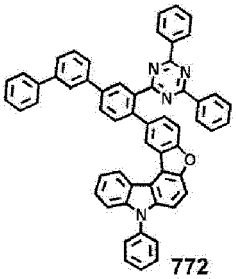

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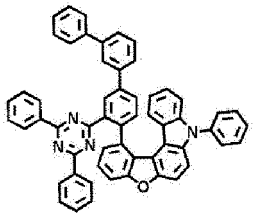

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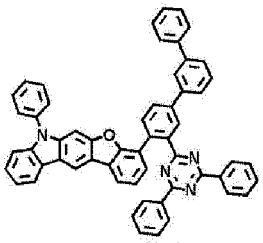

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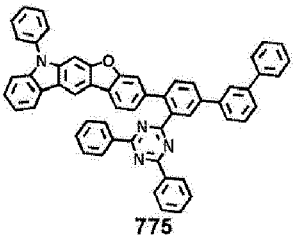

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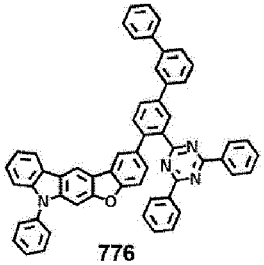

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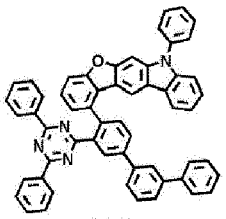

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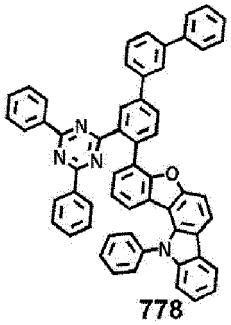

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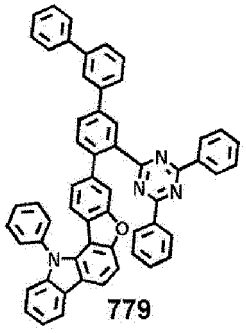

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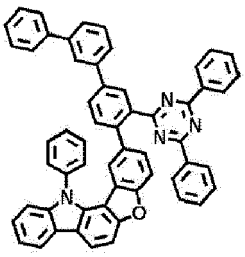

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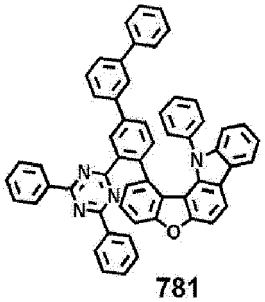

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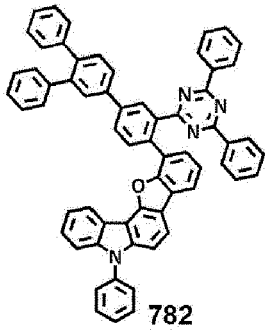

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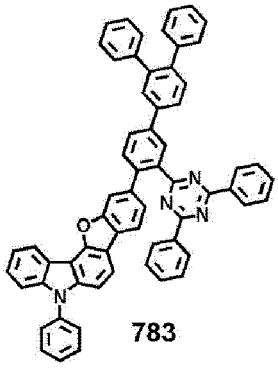

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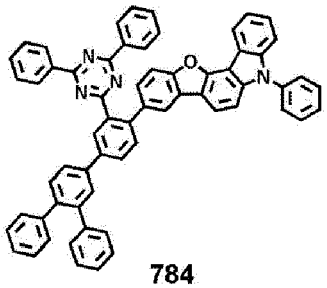

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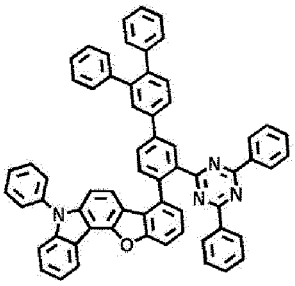

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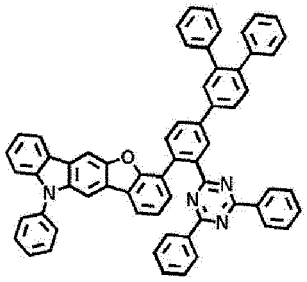

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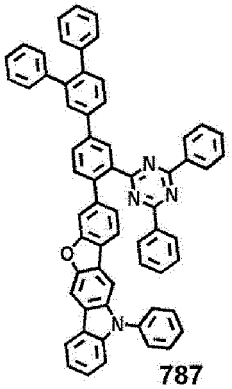

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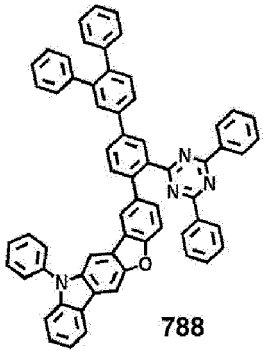

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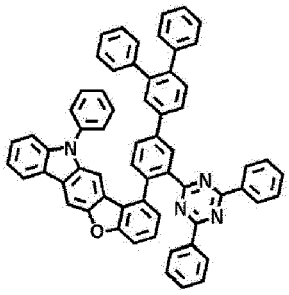
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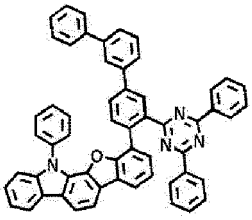
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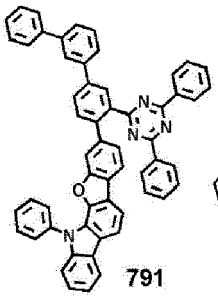
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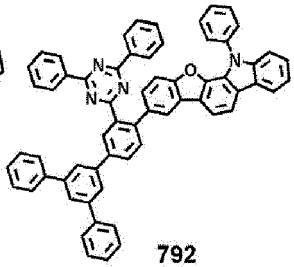
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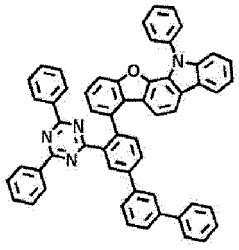
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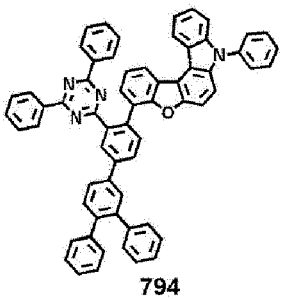
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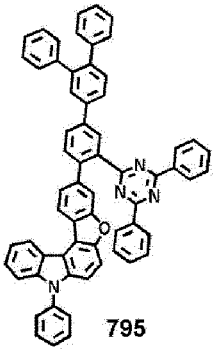
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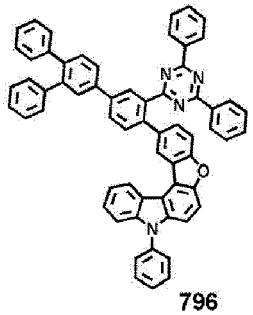
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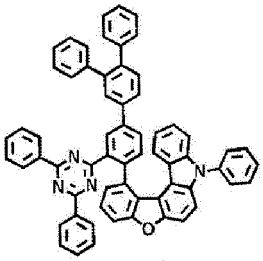
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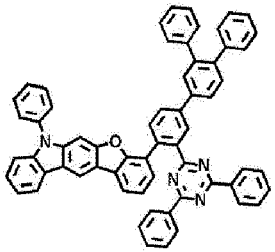
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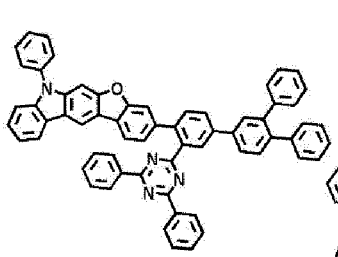
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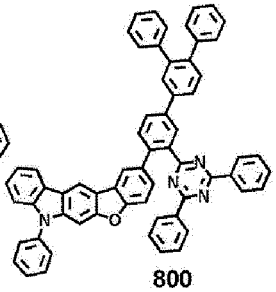
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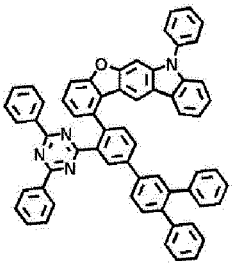
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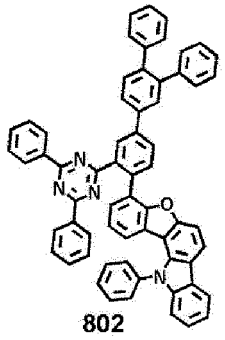
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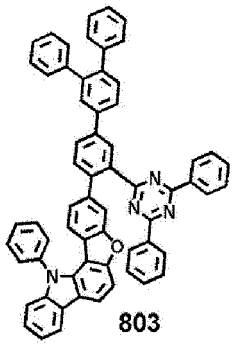


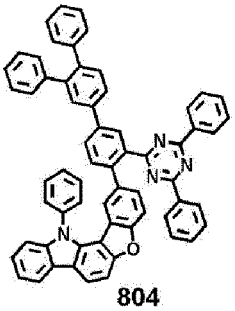
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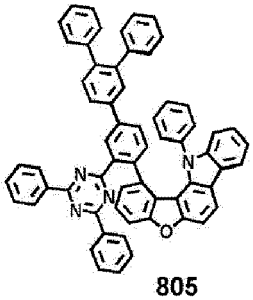


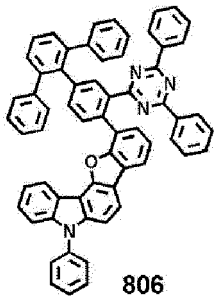
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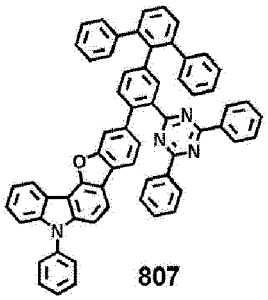

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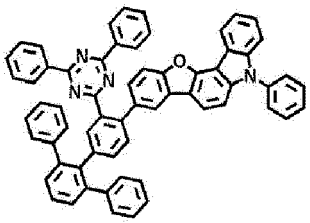

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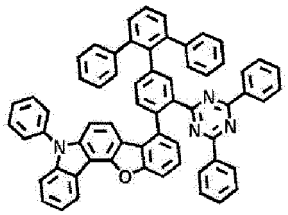

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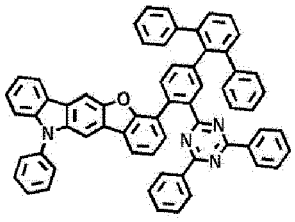

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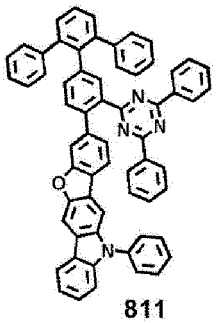

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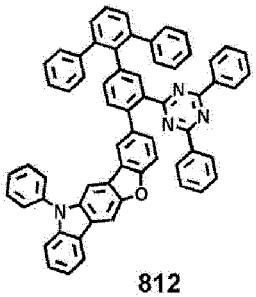

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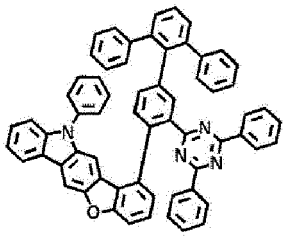

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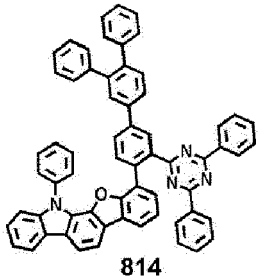

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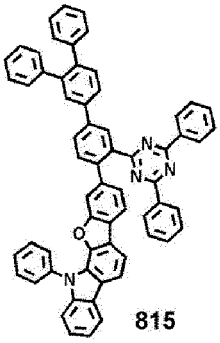

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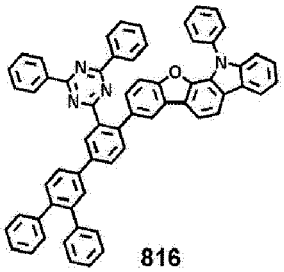

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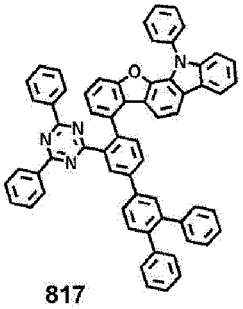

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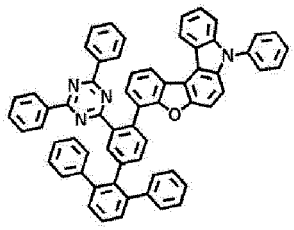

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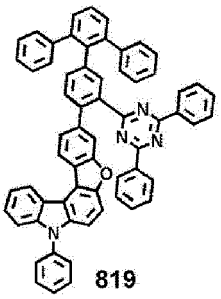

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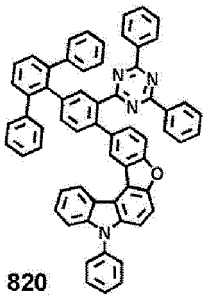

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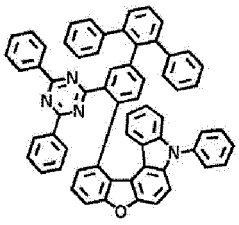
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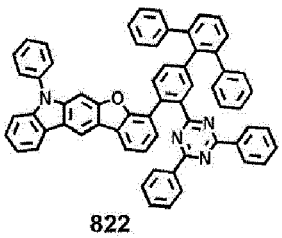
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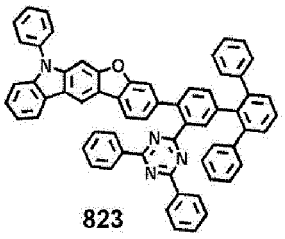
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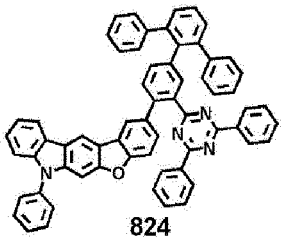
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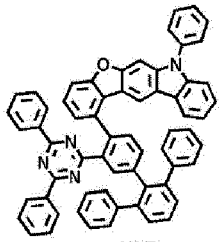
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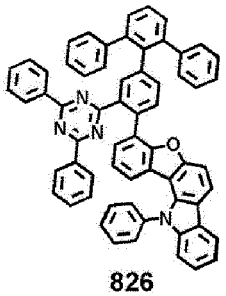
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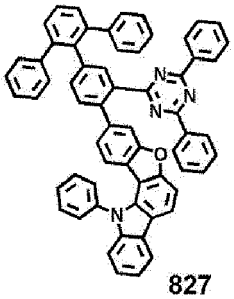
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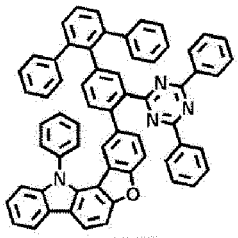
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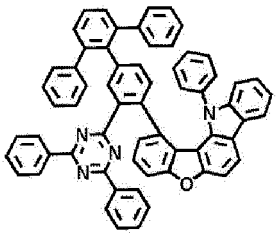
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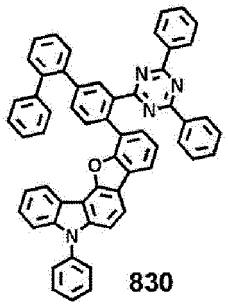
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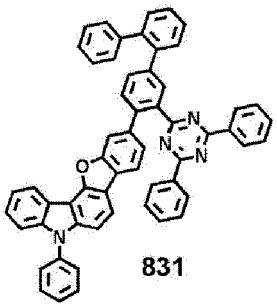
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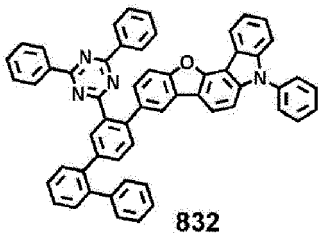
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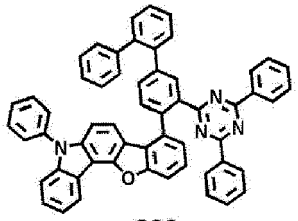
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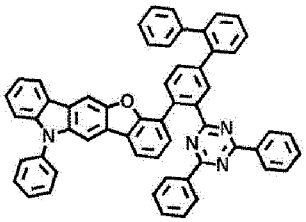
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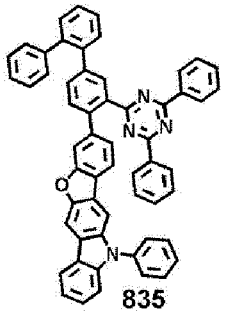
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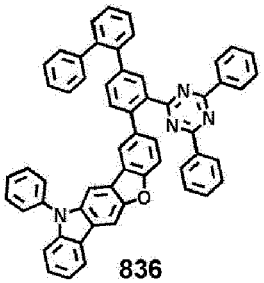
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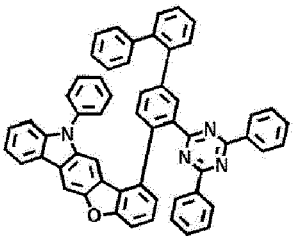
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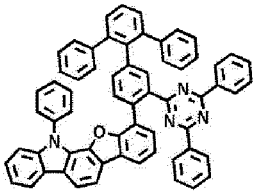
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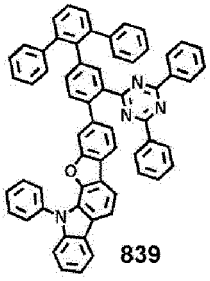
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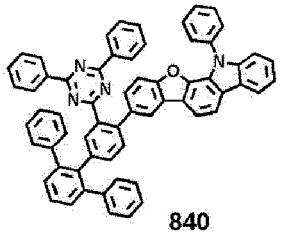
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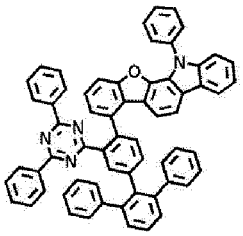
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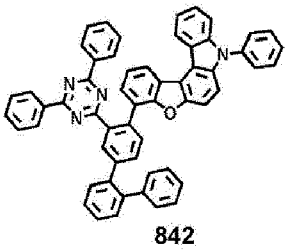
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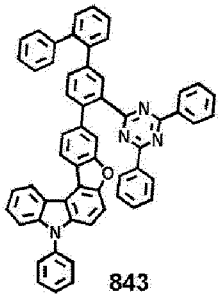
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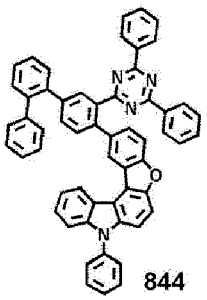
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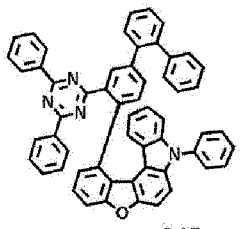
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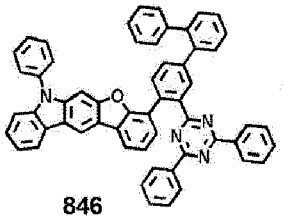
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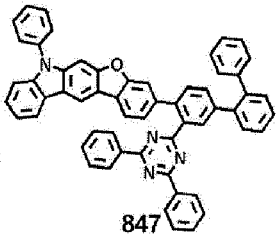
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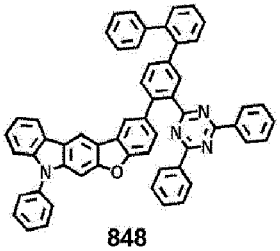
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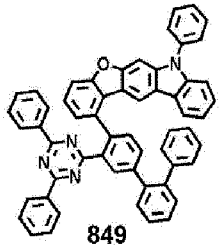
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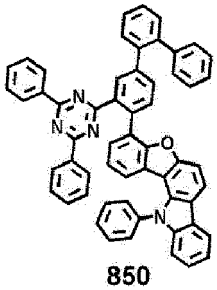
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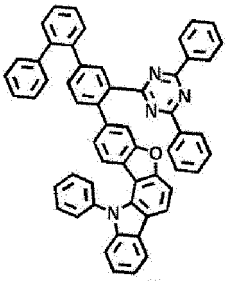
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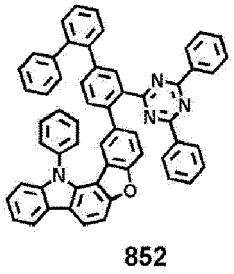
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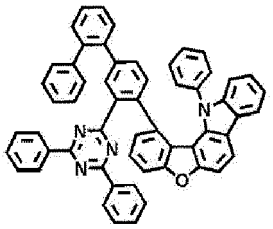
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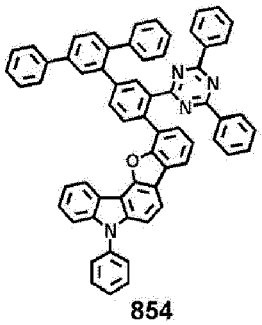
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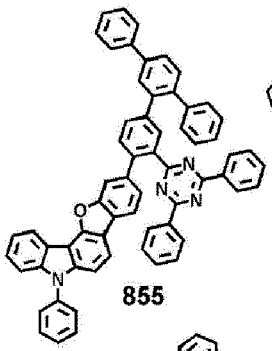
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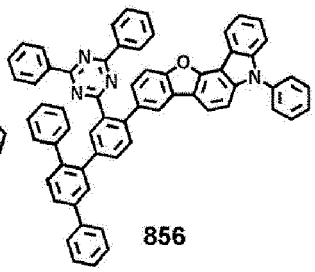
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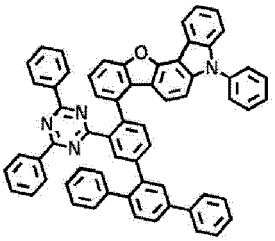
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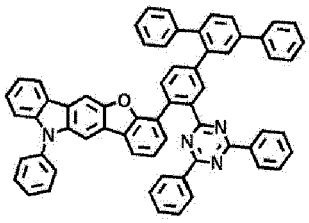
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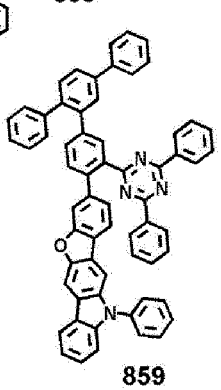
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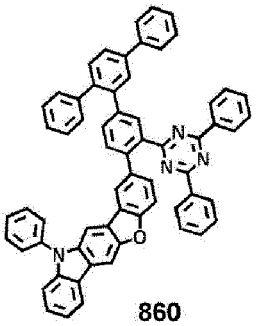
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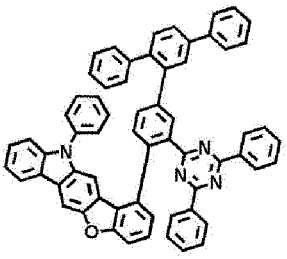
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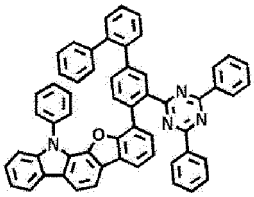
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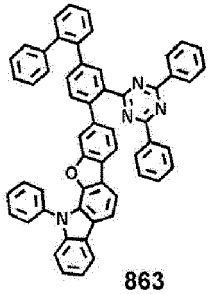
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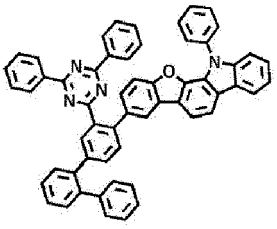
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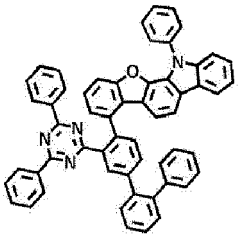
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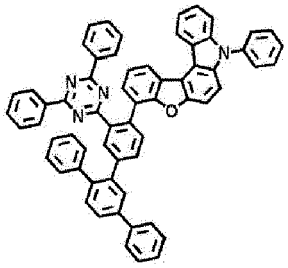
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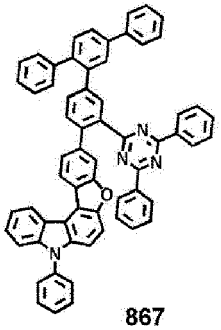
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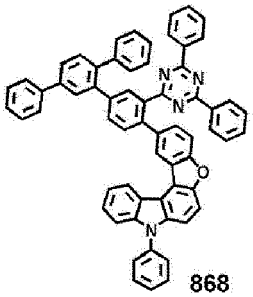
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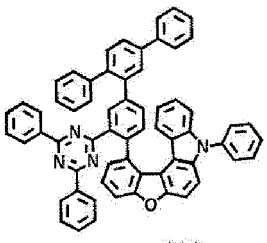
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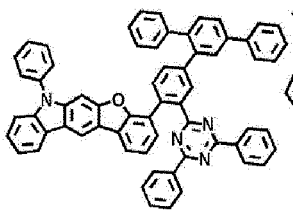
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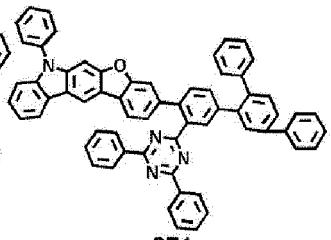
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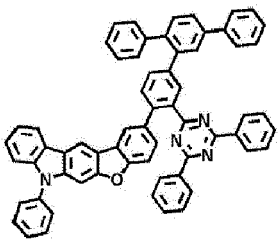
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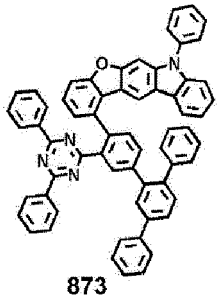
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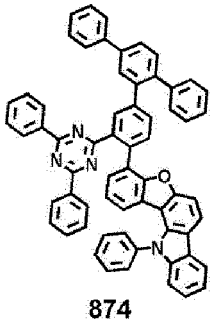
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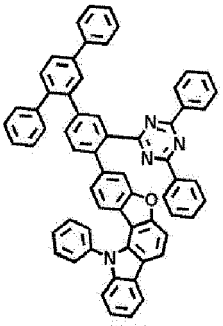
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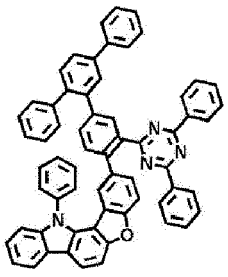
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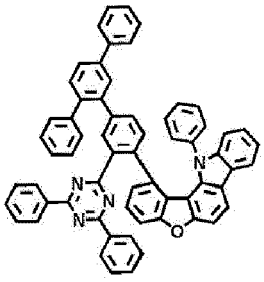
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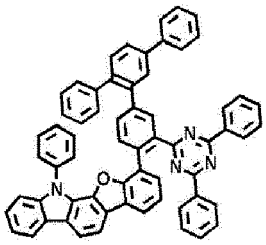
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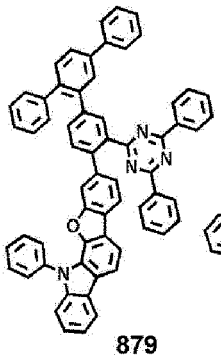
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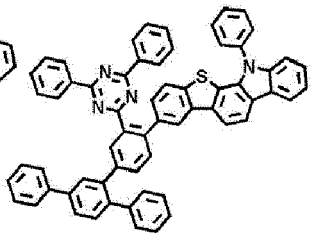
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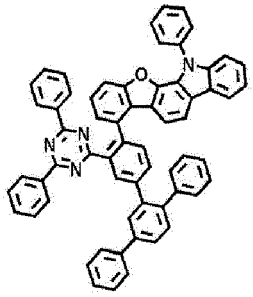
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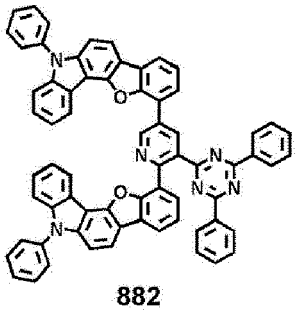
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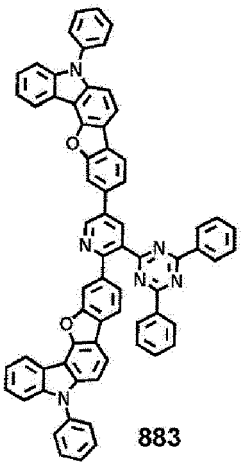
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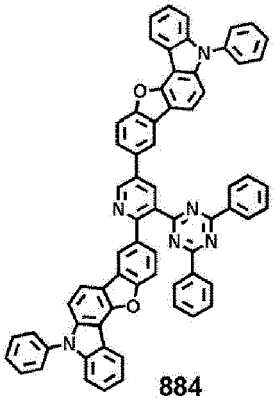
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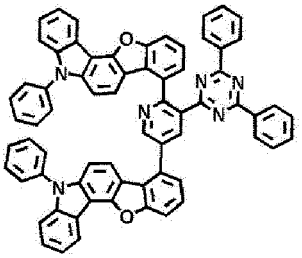
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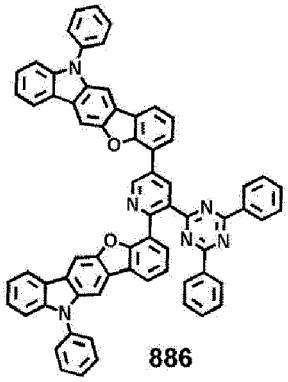
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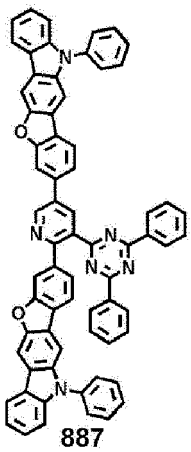
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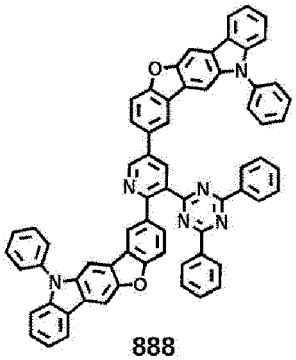
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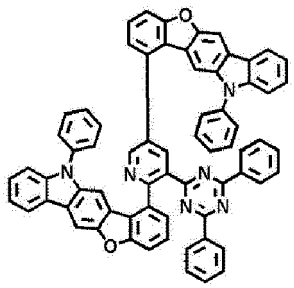
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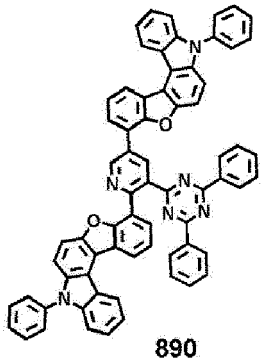
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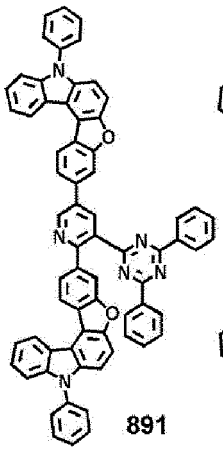
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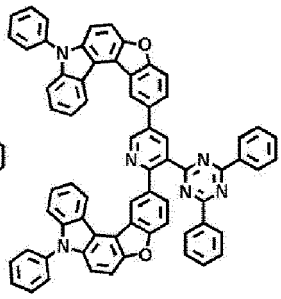
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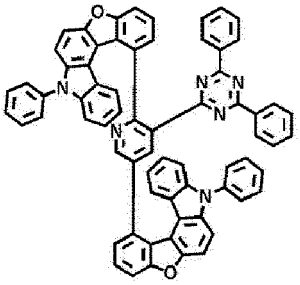
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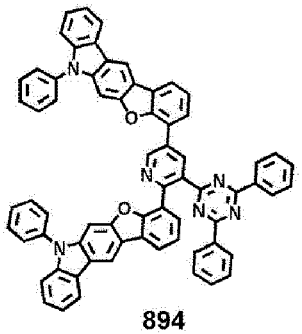
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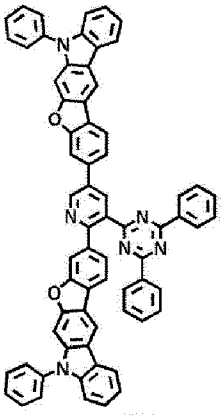
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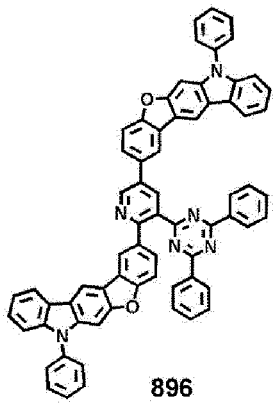
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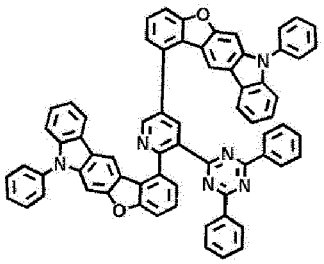
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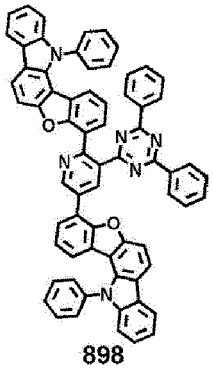
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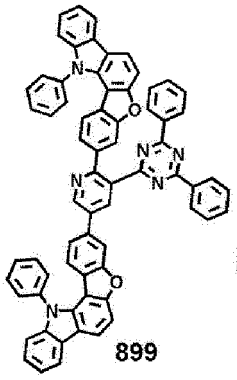
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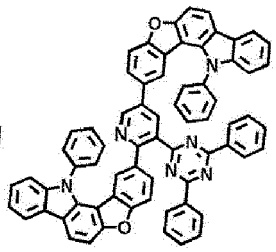
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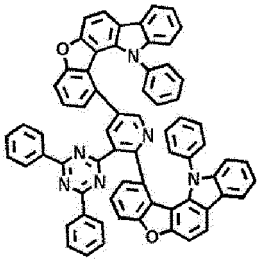
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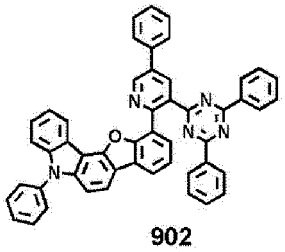
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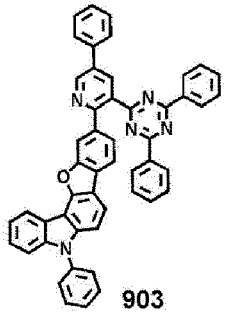
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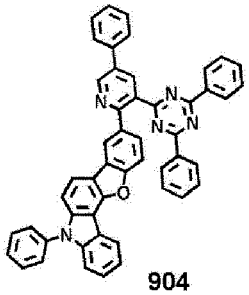
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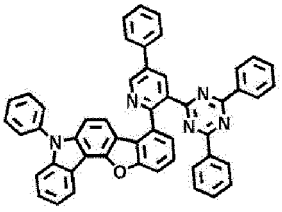
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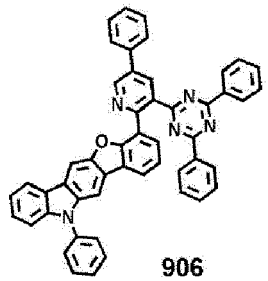
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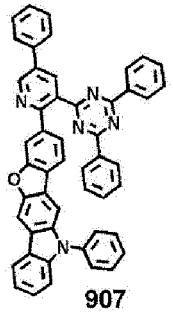


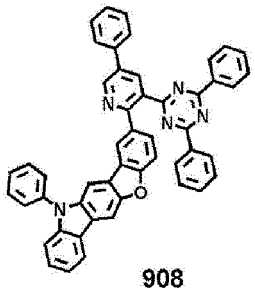
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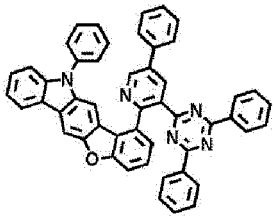


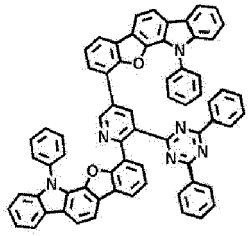
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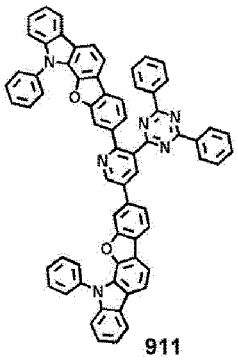

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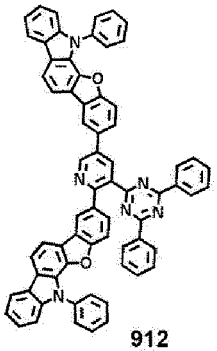

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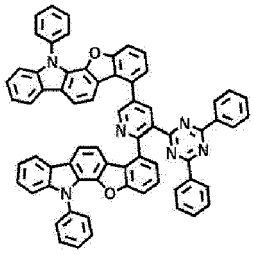

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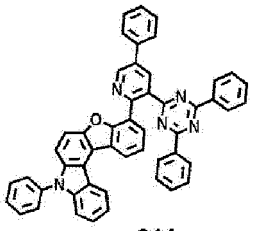

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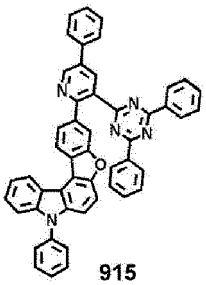

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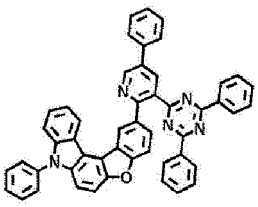

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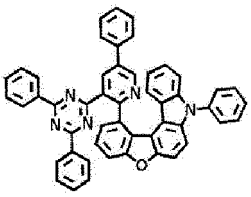

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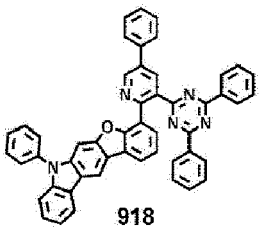

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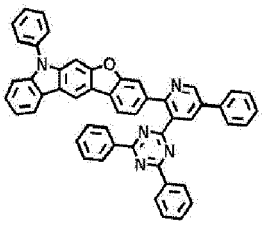

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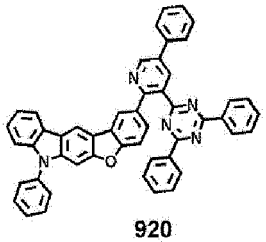

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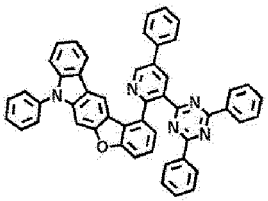

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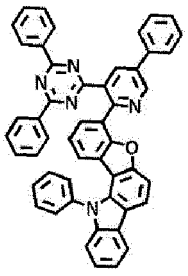

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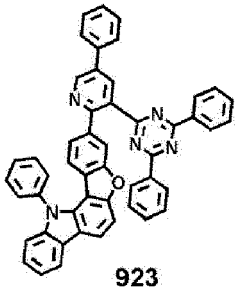

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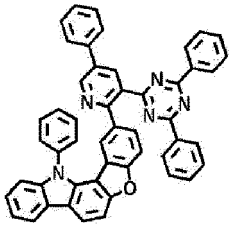

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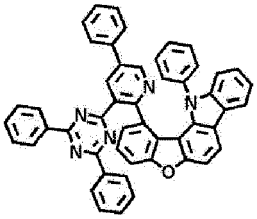

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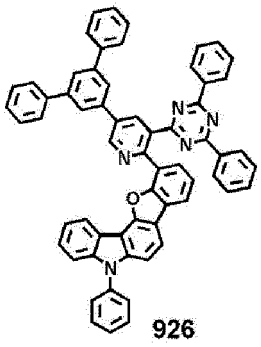

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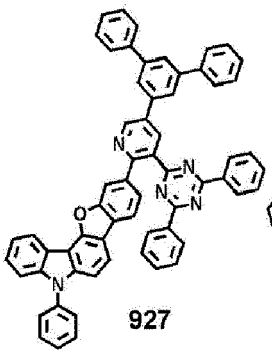

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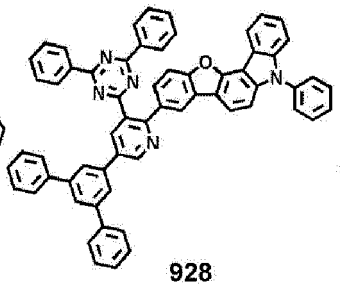

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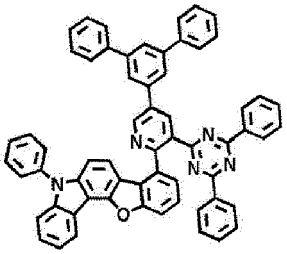

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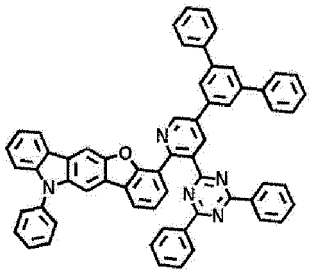

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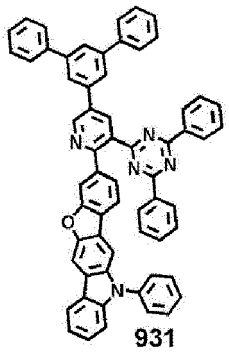

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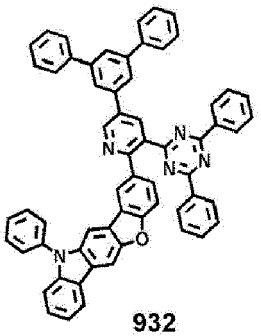

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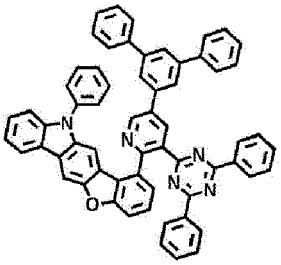

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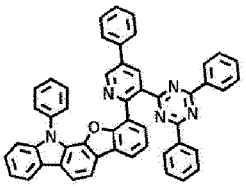

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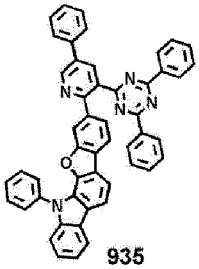

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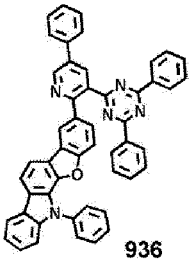

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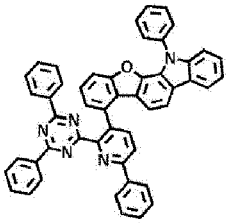

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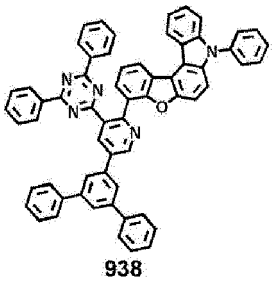

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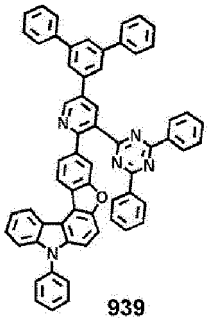

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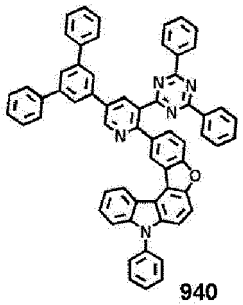

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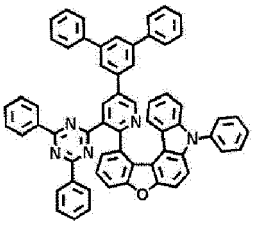

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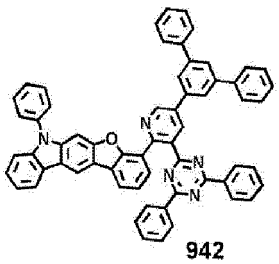

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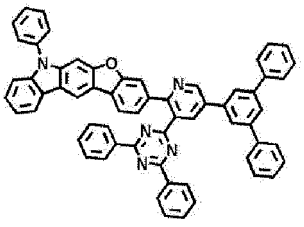

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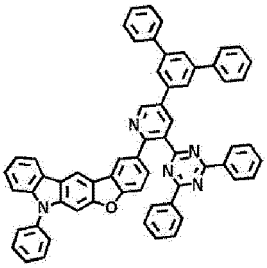

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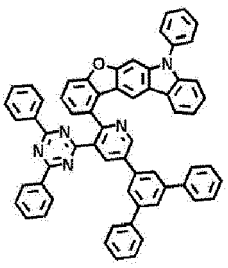

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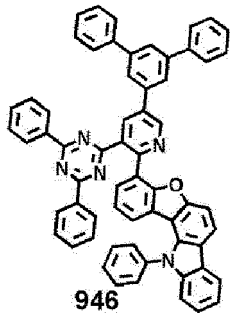

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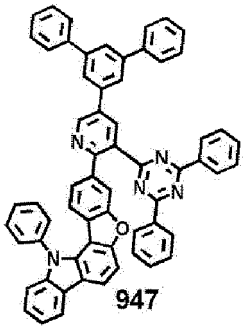

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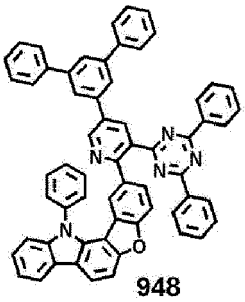

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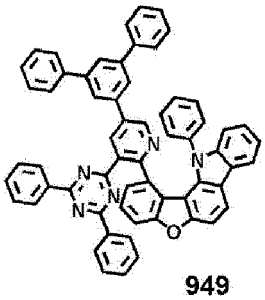

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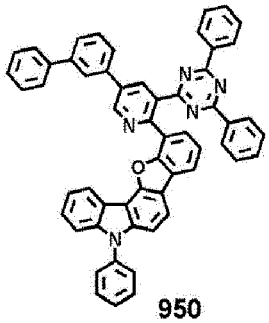

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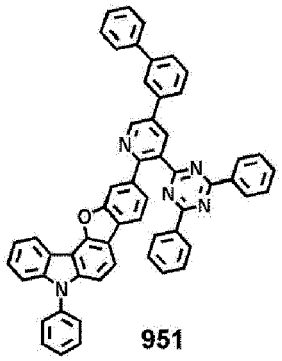

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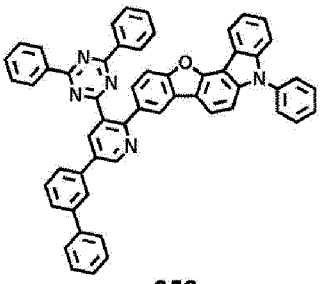

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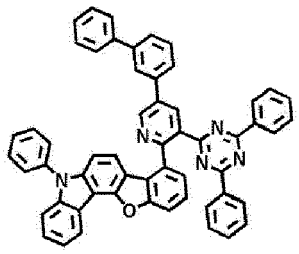

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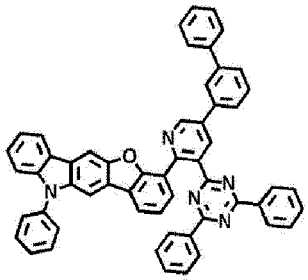

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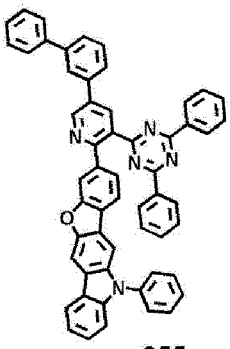

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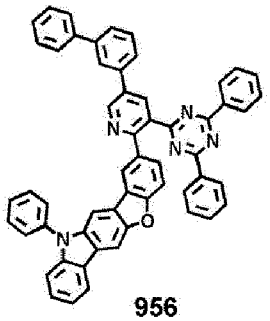

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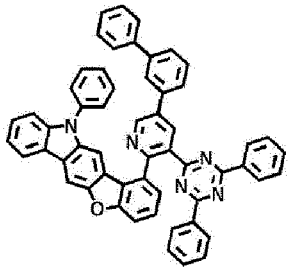

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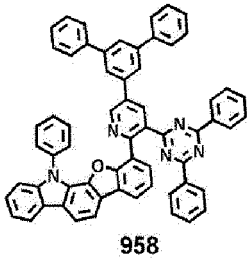

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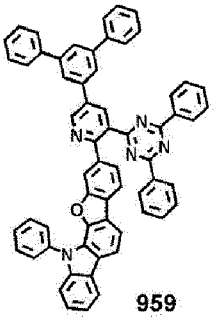

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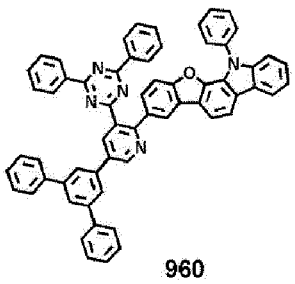

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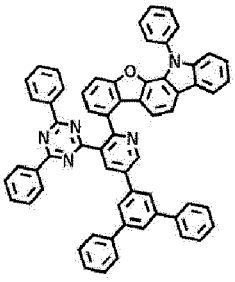

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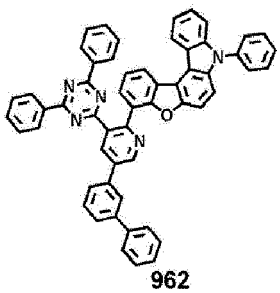

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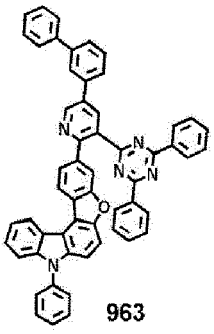

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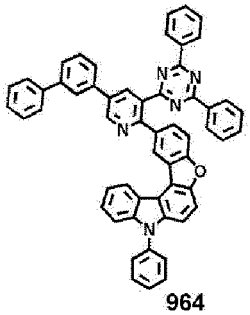

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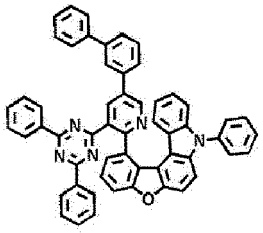

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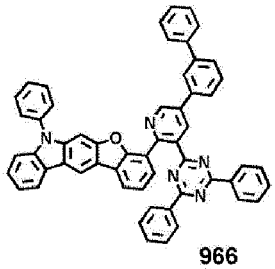

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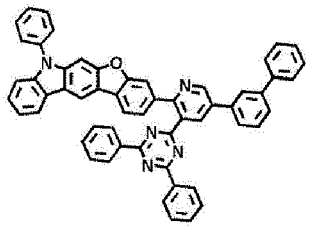

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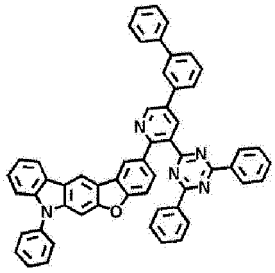

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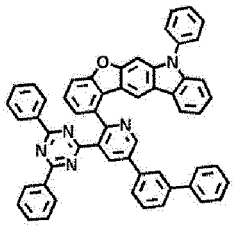

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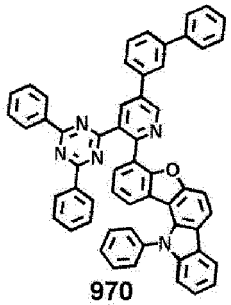

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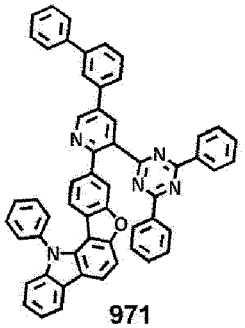

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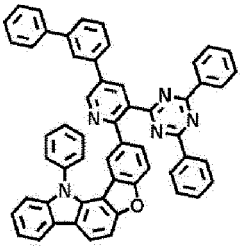

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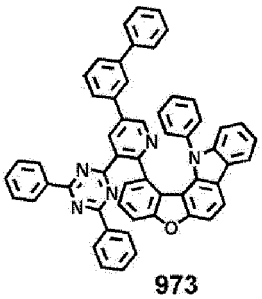

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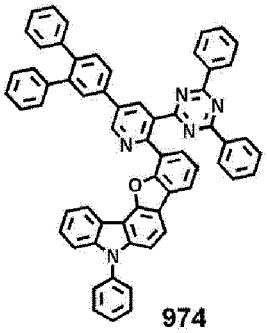

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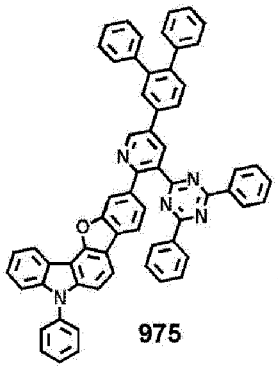

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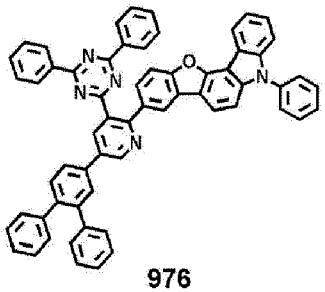

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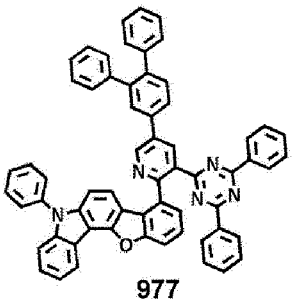

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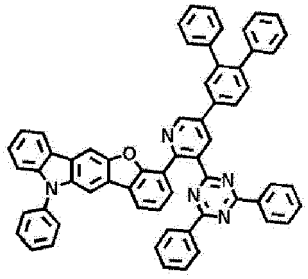

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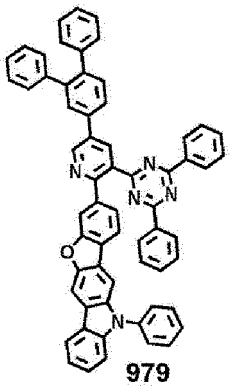

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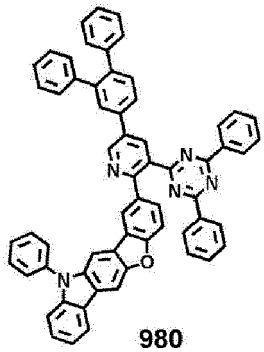

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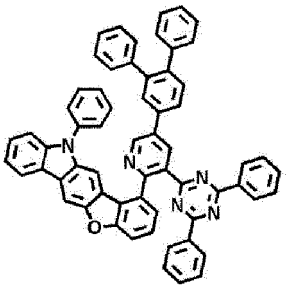
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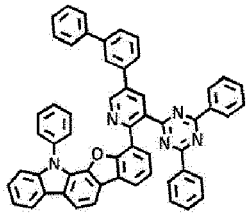
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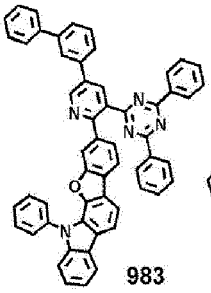
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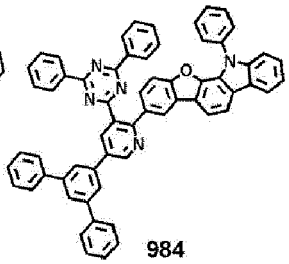
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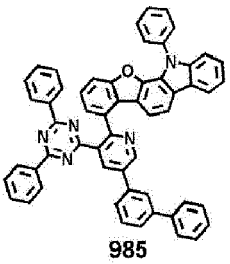
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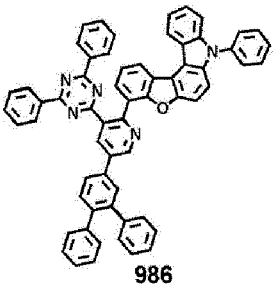
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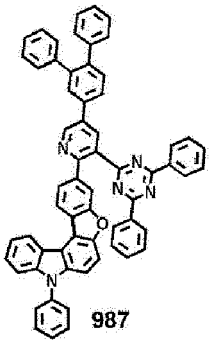
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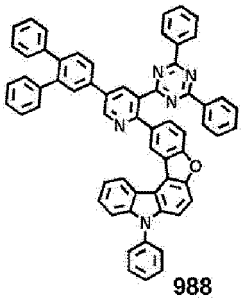
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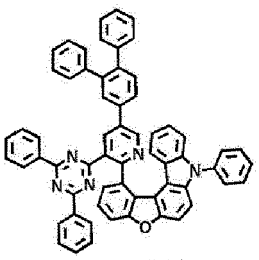
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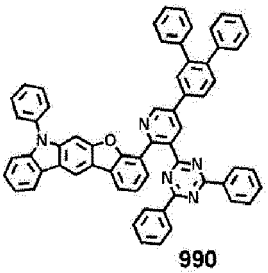
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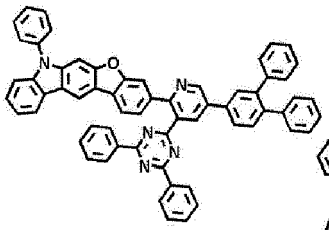
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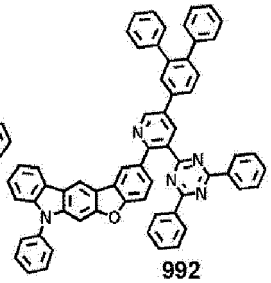
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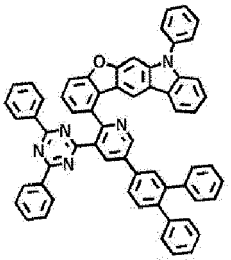
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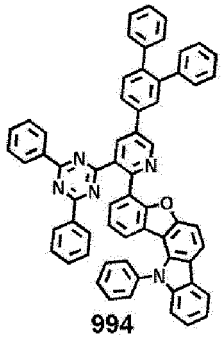
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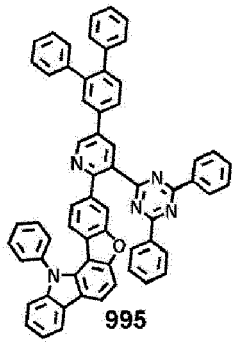


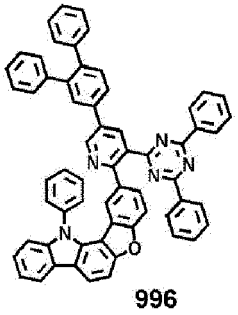
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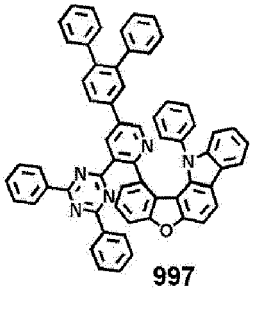


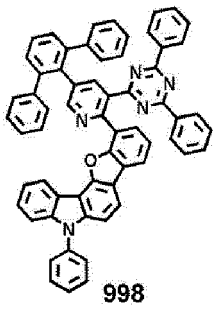
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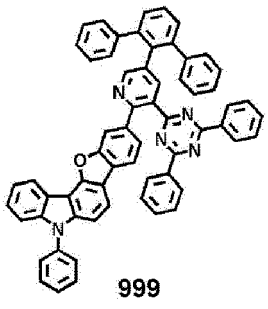

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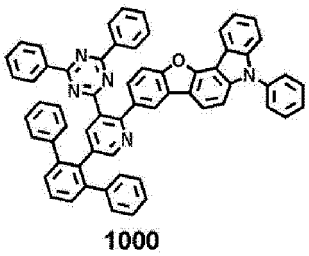

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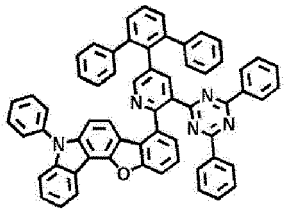

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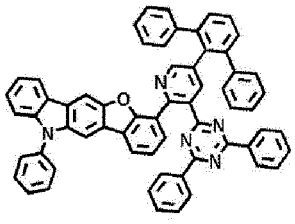

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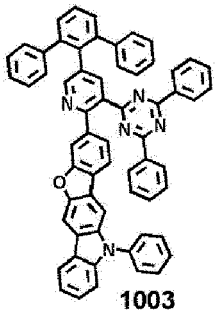

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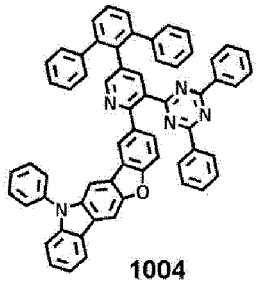

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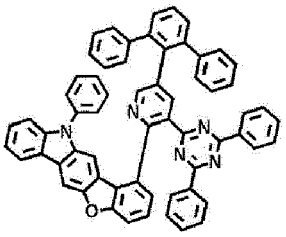

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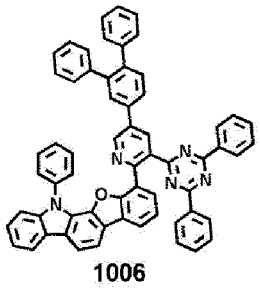

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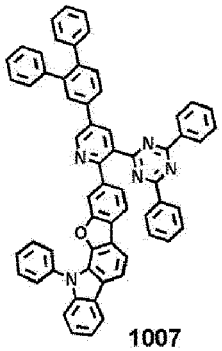

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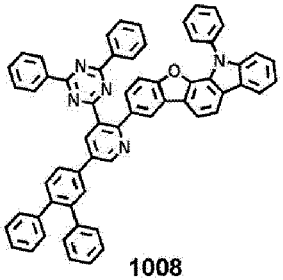

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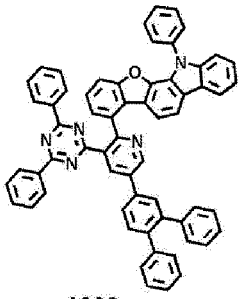

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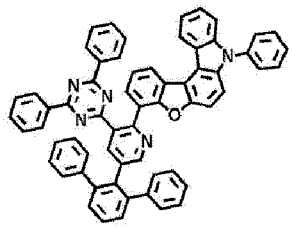

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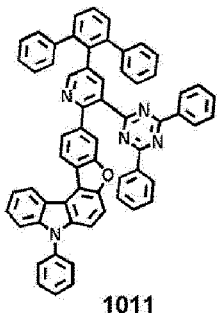

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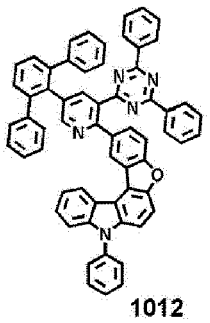

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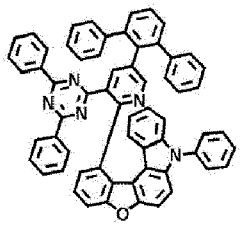
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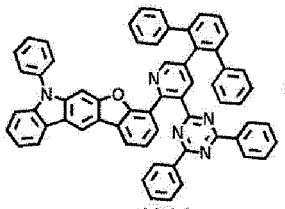
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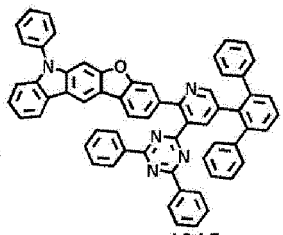
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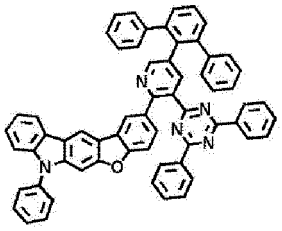
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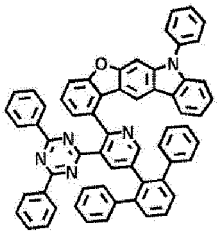
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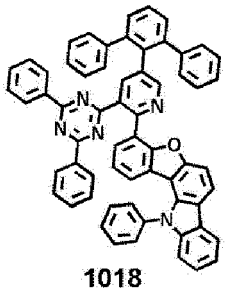
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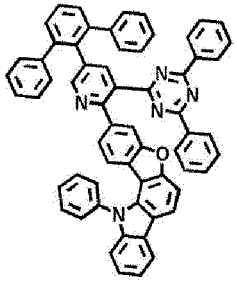
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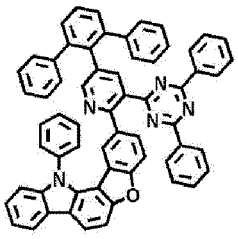
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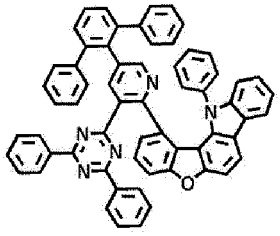
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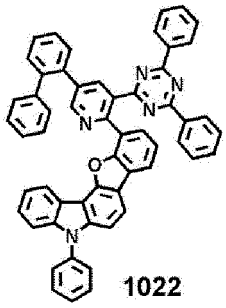
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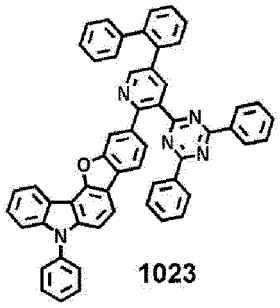
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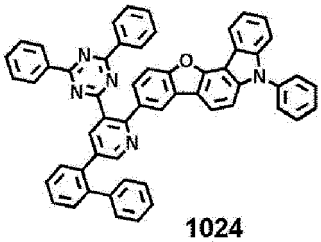
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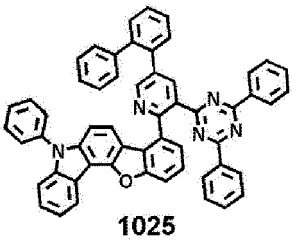
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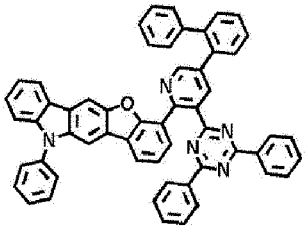
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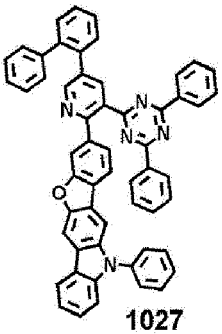
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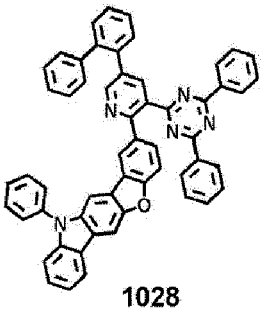
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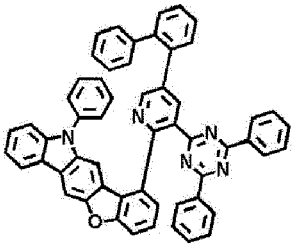
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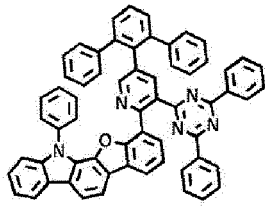
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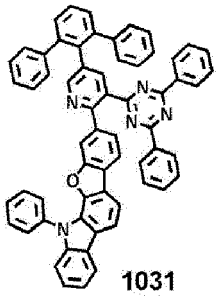
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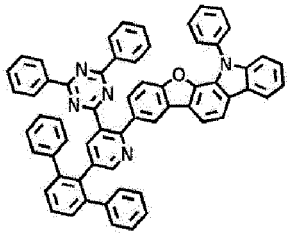
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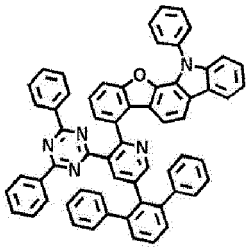
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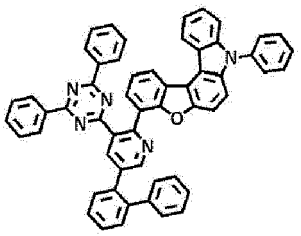
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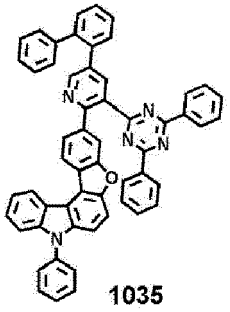
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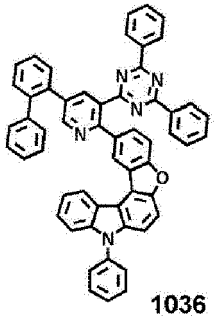
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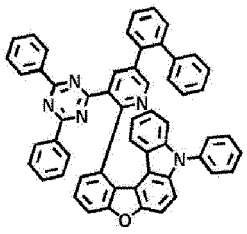
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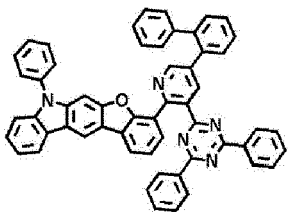
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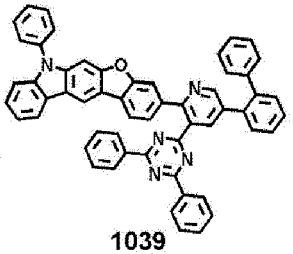
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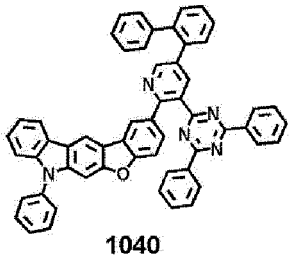
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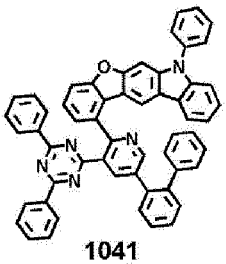
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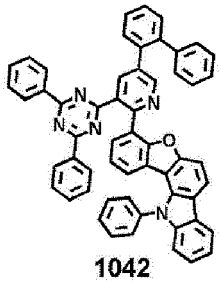
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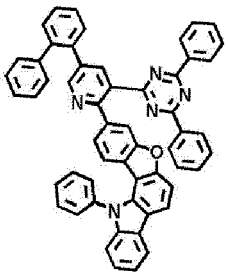
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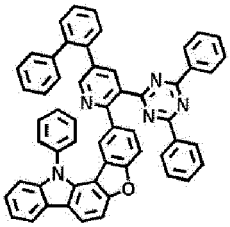
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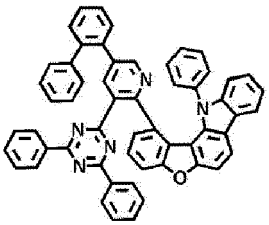
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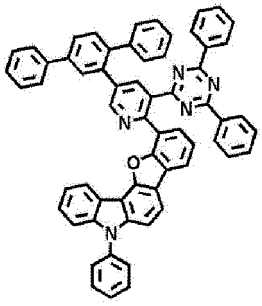
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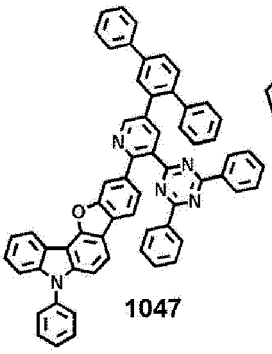
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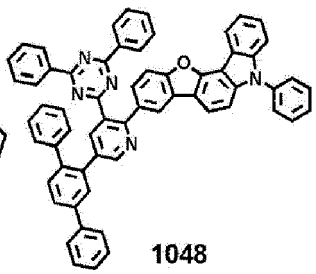
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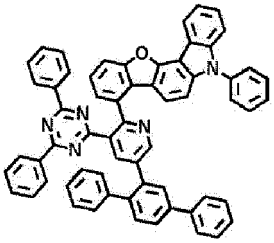
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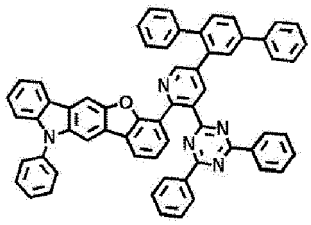
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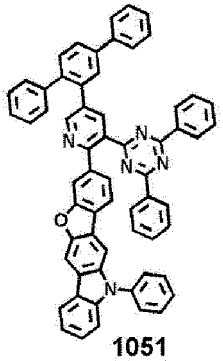
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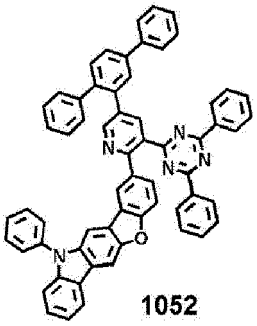
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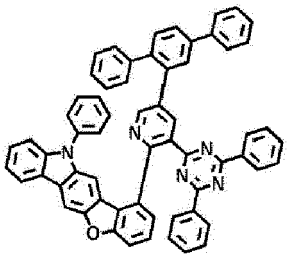
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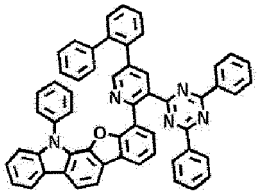
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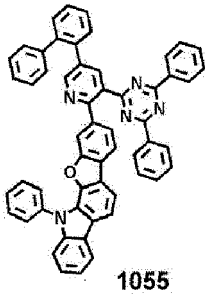
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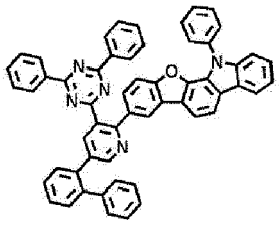
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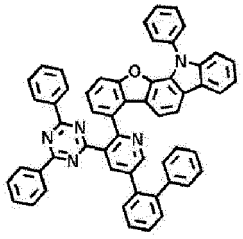
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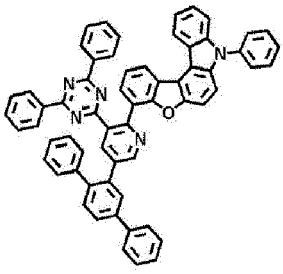
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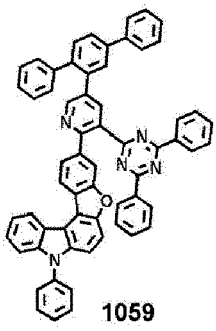
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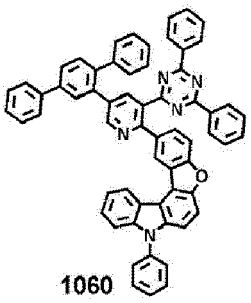
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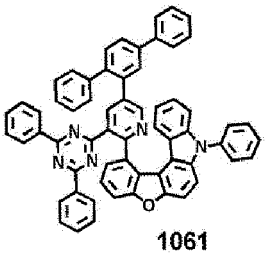
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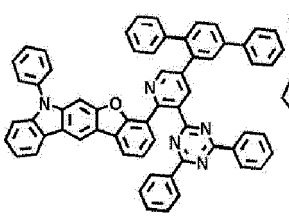
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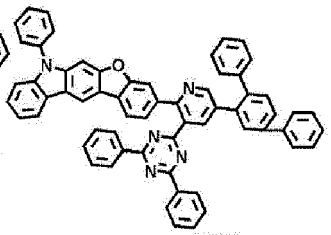
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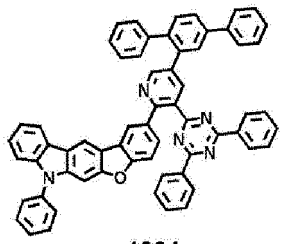
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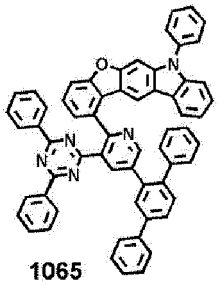
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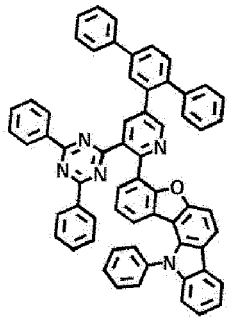
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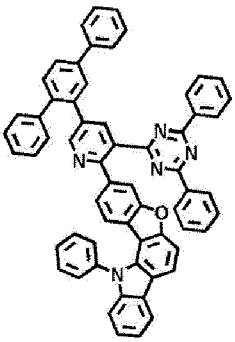
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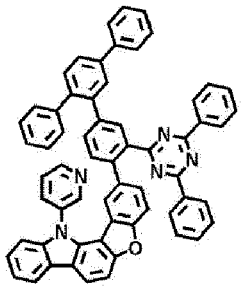
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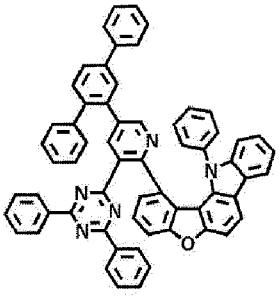
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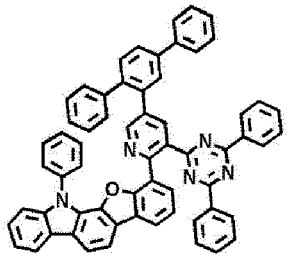
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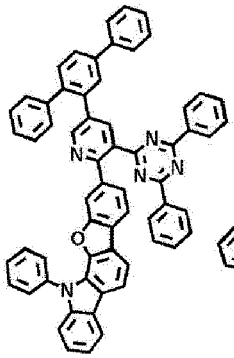
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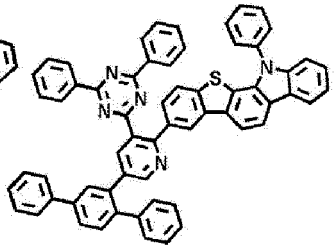
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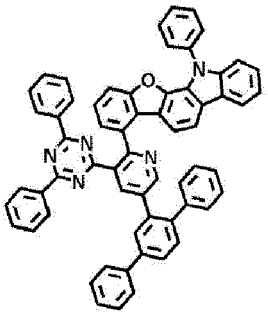
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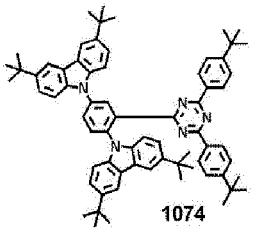
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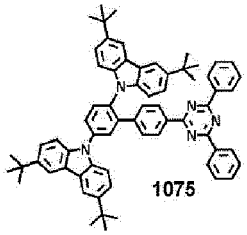
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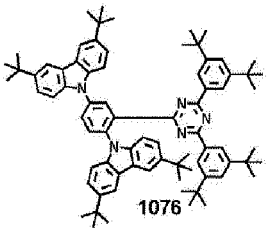
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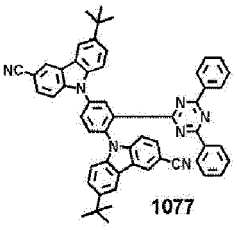
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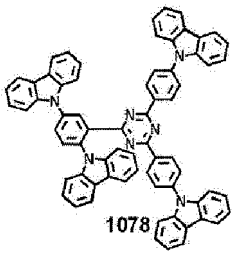
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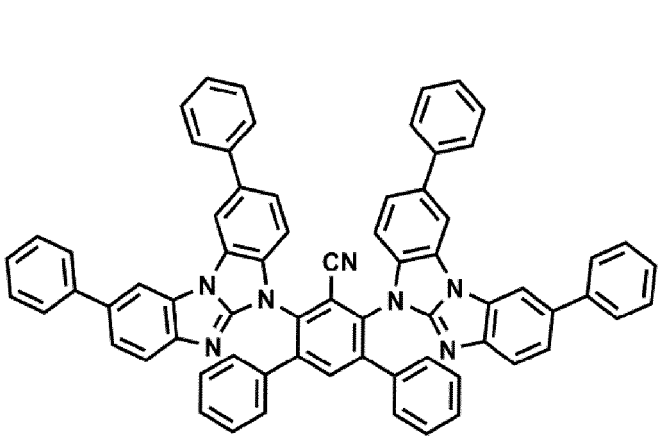


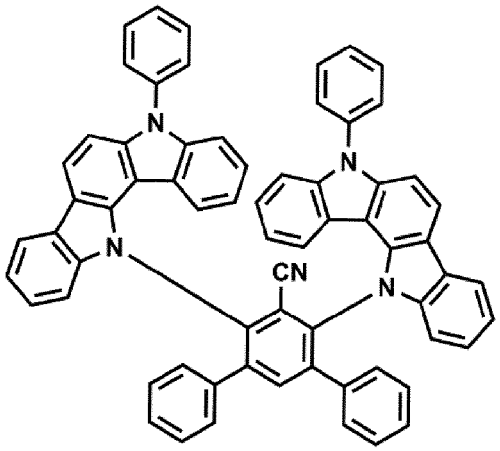
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1078

<group XI>





[Hole transport region 12]

[0099] The hole transport region 12 may be located between the first electrode 11 and the emission layer 15 of the organic light-emitting device 10.

[0100] The hole transport region 12 may have a single-layered structure or a multi-layered structure.

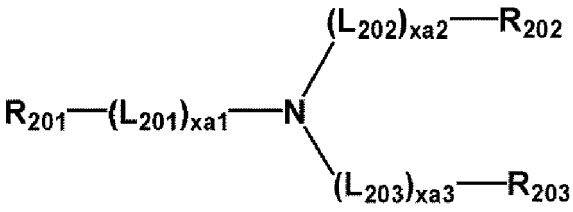
[0101] For example, the hole transport region 12 may have a hole injection layer, a hole transport layer, a hole injection layer/hole transport layer structure, a hole injection layer/first hole transport layer/second hole transport layer structure, a hole transport layer/middle layer structure, a hole injection layer/hole transport layer/middle layer structure, a hole transport layer/electron blocking layer or hole injection layer/hole transport layer/electron blocking layer structure, but embodiments of the present disclosure are not limited thereto.

[0102] The hole transport region 12 may include any compound having hole transport properties.

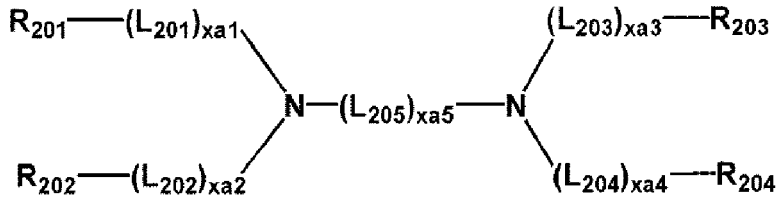
[0103] For example, the hole transport region 12 may include an amine-based compound.

[0104] In one embodiment, the hole transport region 1 may include at least one selected from a compound represented by Formula 201 to a compound represented by Formula 205, but embodiments of the present disclosure are not limited thereto:

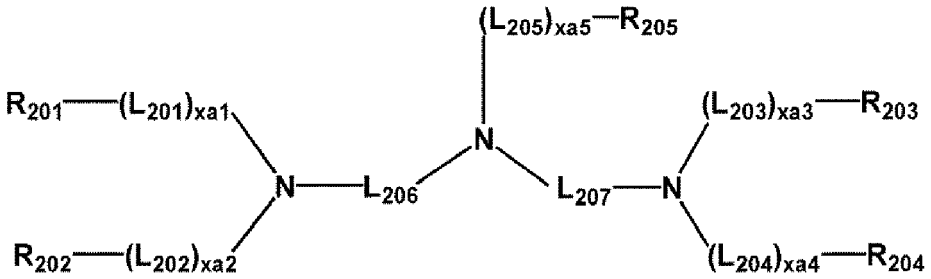
<Formula 201>



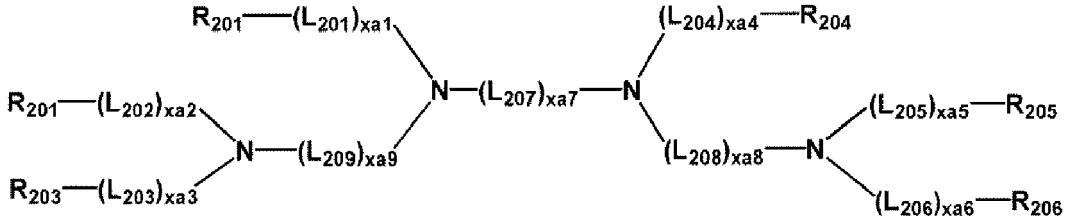
<Formula 202>



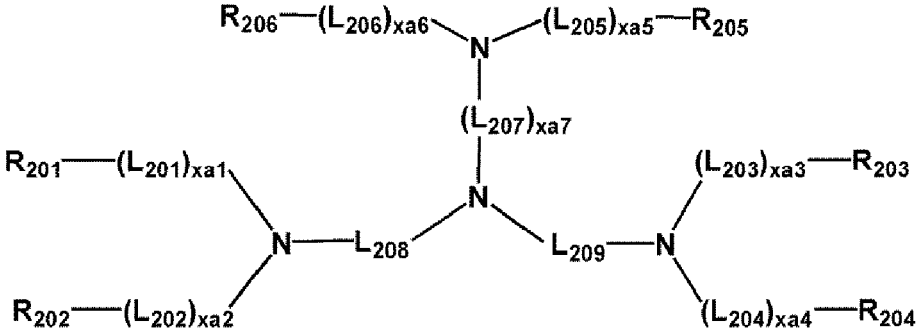
<Formula 203>



<Formula 204>



<Formula 205>



wherein, in Formulae 201 to 205,

L_{201} to L_{209} may each independently *-be O-*', *-S-*', a substituted or unsubstituted C_5-C_{60} carbocyclic group, or a substituted or unsubstituted C_1-C_{60} heterocyclic group,
xa1 to xa9 may each independently be an integer from 0 to 5, and
R_{201} to R_{206} may each independently be selected from a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10}heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, and a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group, wherein neighboring two groups of R_{201} to R_{206} may optionally be linked to each other via a single bond, a dimethyl-methylene group, or a diphenyl-methylene group.

[0105] For example,
L_{201} to L_{209} may be selected from a benzene group, a heptalene group, an indene group, a naphthalene group, an azulene group, a heptalene group, an indacene group, an acenaphthylene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentacene group, a hexacene group, a pentaphene group, a rubicene group, a coronene group, an ovalene group, a pyrrole group, an isoindole group, an indole group, a furan group, a thiophene group, a

benzofuran group, a benzothiophene group, a benzocarbazole group, a dibenzocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzothiophene sulfone group, a carbazole group, a dibenzosilole group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, a benzothienocarbazole group, and a triindolobenzene group, each unsubstituted or substituted with at least one selected from deuterium, a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a naphthyl group, a fluorenyl group, a carbazolyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a triphenylenyl group, a biphenyl group, a terphenyl group, a tetraphenyl group, and $-Si(Q_{11})(Q_{12})(Q_{13})$,

xa1 to xa9 may each independently be 0, 1, or 2, and

R_{201} to R_{206} may each independently be selected from a phenyl group, a biphenyl group, a terphenyl group, a pentalenyl group, an indenyl group, a naphthyl group, an azulenyl group, a heptalenyl group, an indacenyl group, an acenaphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenalenyl group, a phenanthrenyl group, an anthracenyl group, a fluoranthenyl group, a triphenylenyl group, a pyrenyl group, a chrysenyl group, a naphthacenyl group, a picenyl group, a perylenyl group, a pentaphenyl group, a hexacenyl group, a pentacenyl group, a rubicenyl group, a coronenyl group, an ovalenyl group, a thiophenyl group, a furanyl group, a carbazolyl group, an indolyl group, an isoindolyl group, a benzofuranyl group, a benzothiophenyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a benzocarbazolyl group, a dibenzocarbazolyl group, a dibenzosilolyl group, a pyridinyl group, an indeno carbazolyl group, an indolocarbazolyl group, a benzofurocarbazolyl group, and a benzothienocarbazolyl group, each unsubstituted or substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a cyclopentyl group, a cyclohexyl group, a cycloheptyl group, a cyclopentenyl group, a cyclohexenyl group, a phenyl group, a biphenyl group, a terphenyl group, a phenyl group substituted with a C_1-C_{10} alkyl group, a phenyl group substituted with -F, a pentalenyl group, an indenyl group, a naphthyl group, an azulenyl group, a heptalenyl group, an indacenyl group, an acenaphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenalenyl group, a phenanthrenyl group, an anthracenyl group, a fluoranthenyl group, a triphenylenyl group, a pyrenyl group, a chrysenyl group, a naphthacenyl group, a picenyl group, a perylenyl group, a pentaphenyl group, a hexacenyl group, a pentacenyl group, a rubicenyl group, a coronenyl group, an ovalenyl group, a thiophenyl group, a furanyl group, a carbazolyl group, an indolyl group, an isoindolyl group, a benzofuranyl group, a benzothiophenyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a benzocarbazolyl group, a dibenzocarbazolyl group, a dibenzosilolyl group, a pyridinyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, and $-N(Q_{31})(Q_{32})$,

wherein Q_{11} to Q_{13} and Q_{31} to Q_{33} may each independently be selected from a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, and a naphthyl group.

[0106] In one or more embodiments, the hole transport region 12 may include a carbazole-containing amine-based compound.

[0107] In one embodiment, the hole transport region 12 may include a carbazole-containing amine-based compound and a carbazole-free amine-based compound.

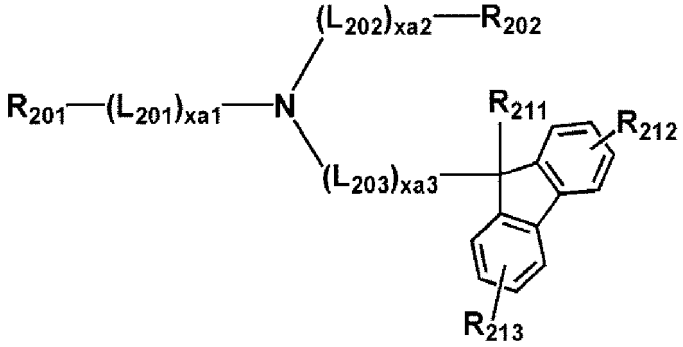
[0108] The carbazole-containing amine-based compound may be selected from, for example, compounds represented by Formula 201 including a carbazole group and further including at least one selected from a dibenzofuran group, a dibenzothiophene group, a fluorene group, a spiro-bifluorene group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, and a benzothienocarbazole group.

[0109] The carbazole-free amine-based compound may be selected from, for example, compounds represented by Formula 201 which do not include a carbazole group and which include at least one selected from a dibenzofuran group, a dibenzothiophene group, a fluorene group, a spiro-bifluorene group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, and a benzothienocarbazole group.

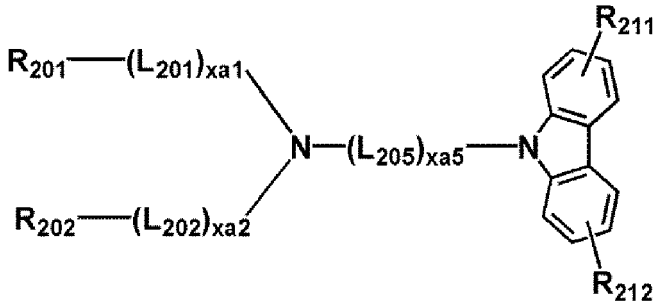
[0110] In one or more embodiments, the hole transport region 12 may include at least one selected from compounds represented by Formulae 201 or 202.

[0111] In one embodiment, the hole transport region 12 may include at least one selected from compounds represented by Formulae 201-1, 202-1 and 201-2, but embodiments of the present disclosure are not limited thereto:

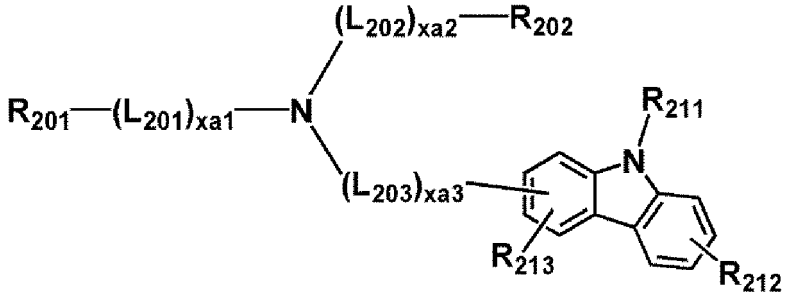
<Formula 201-1>



<Formula 202-1>

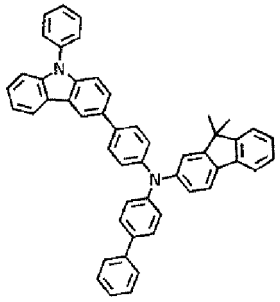


<Formula 201-2>

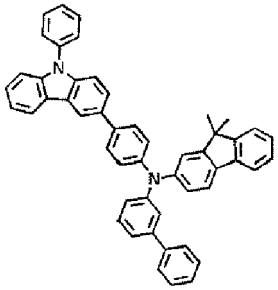


[0112] In Formulae 201-1, 202-1, and 201-2, L_{201} to L_{203}, L_{205}, xa1 to xa3, xa5, R_{201} and R_{202} are the same as described herein, and R_{211} to R_{213} are each independently selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a phenyl group substituted with a C_1-C_{10} alkyl group, a phenyl group substituted with -F, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a dimethylfluorenyl group, a diphenyla fluorenyl group, a triphenylenyl group, a thiophenyl group, a furanyl group, a carbazolyl group, an indolyl group, an isoindolyl group, a benzofuranyl group, a benzothiophenyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a benzocarbazolyl group, a dibenzocarbazolyl group, a dibenzosilolyl group, and a pyridinyl group.

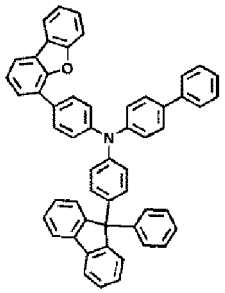
[0113] For example, the hole transport region 12 may include at least one selected from Compounds HT1 to HT39, but embodiments of the present disclosure are not limited thereto.



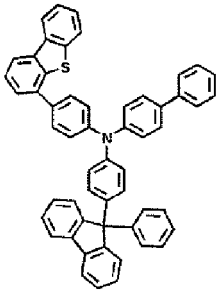
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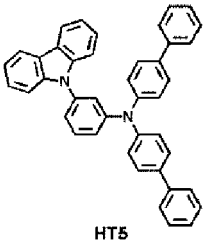
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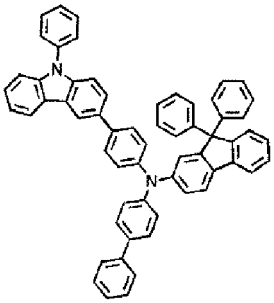
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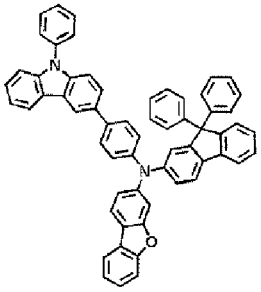
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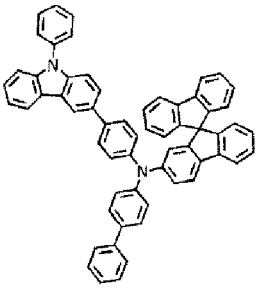
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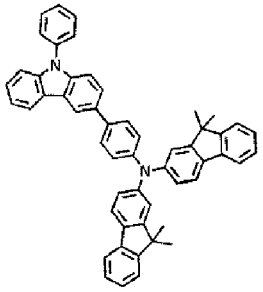
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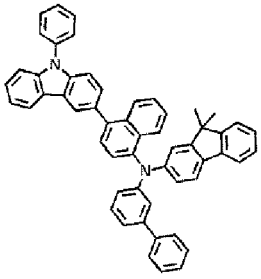
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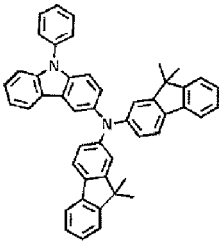
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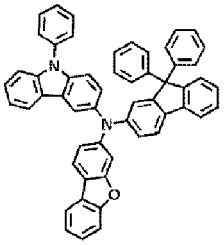
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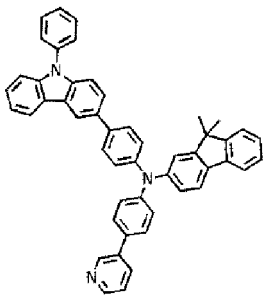
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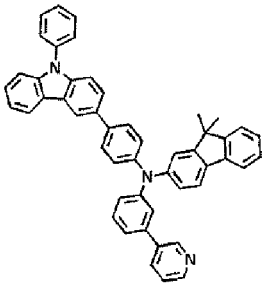
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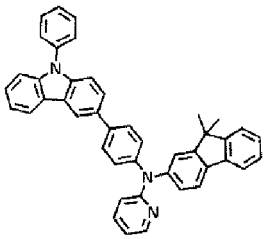
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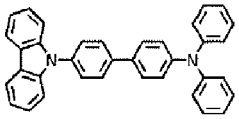
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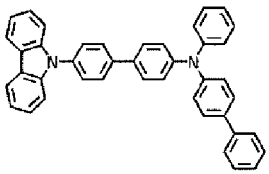
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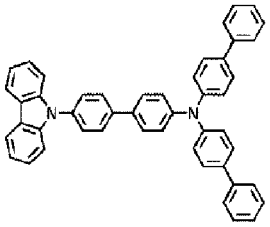
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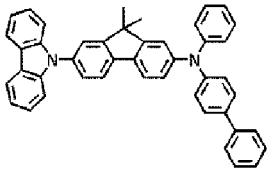
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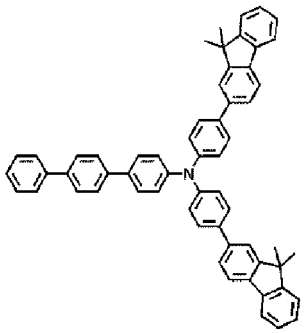
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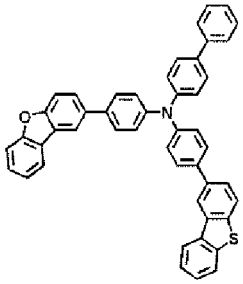
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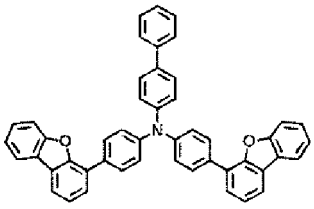
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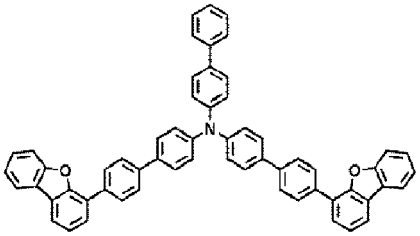
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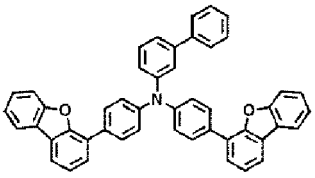
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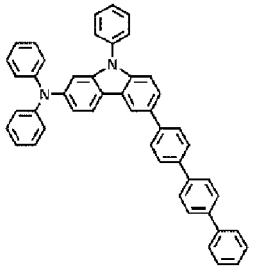
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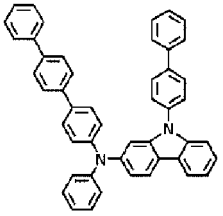
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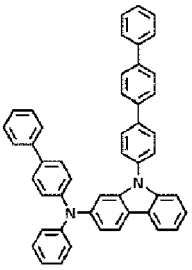
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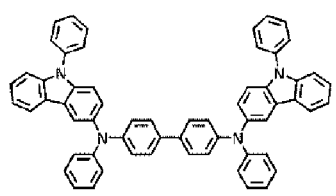
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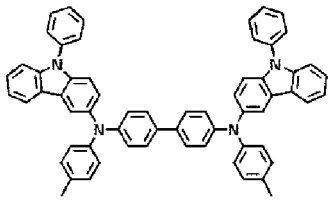
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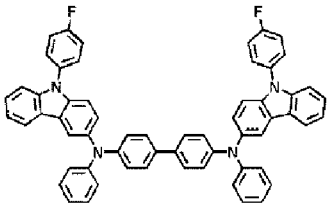
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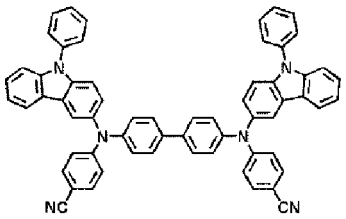
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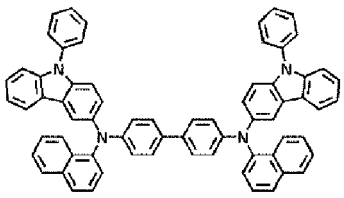
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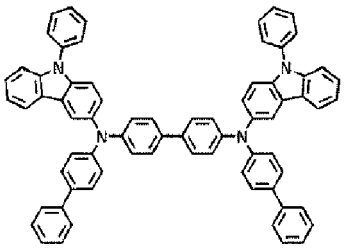
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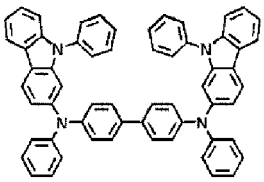
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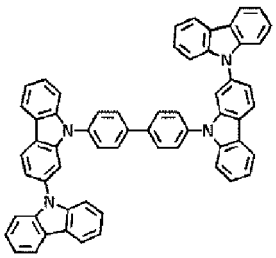
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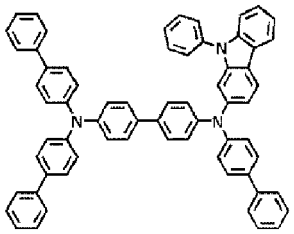
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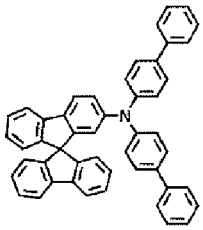
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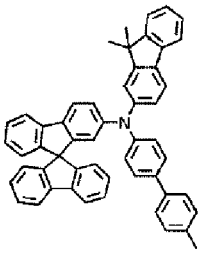
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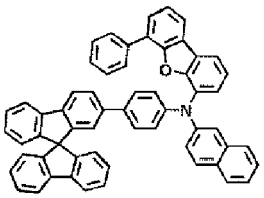
HT36



HT37



HT38



HT39

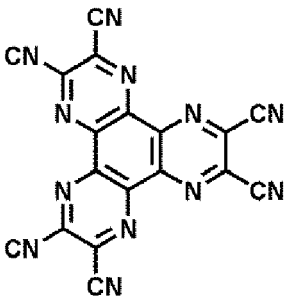
[0114] In one or more embodiments, hole transport region 12 of the organic light-emitting device 10 may further include a p-dopant. When the hole transport region 12 further includes a p-dopant, the hole transport region 12 may have a matrix (for example, at least one of compounds represented by Formulae 201 to 205) and a p-dopant included in the matrix. The p-dopant may be uniformly or non-uniformly doped in the hole transport region 12.

[0115] In one embodiment, the LUMO energy level of the p-dopant may be -3.5 eV or less.

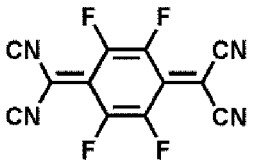
[0116] The p-dopant may include at least one selected from a quinone derivative, a metal oxide, and a cyano-containing compound, but embodiments of the present disclosure are not limited thereto.

[0117] In one embodiment, the p-dopant may include at least one selected from:

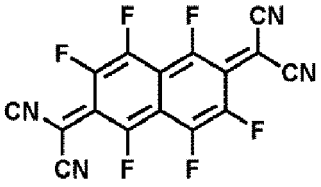
a quinone derivative, such as tetracyanoquinodimethane (TCNQ),2,3,5,6-tetrafluoro-7,7,8,8-tetracyanoquinodimethane (F4-TCNQ), and F6-TCNNQ;
a metal oxide, such as tungsten oxide or molybdenum oxide;
1,4,5,8,9,12-hexaazatriphenylene-hexacarbonitrile (HAT-CN); and
a compound represented by Formula 221 below,
but embodiments of the present disclosure are not limited thereto:



HAT-CN

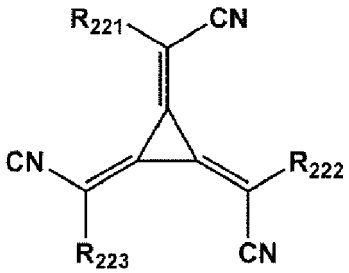


F4-TCNQ



F6-TCNNQ

<Formula 221>



[0118] In Formula 221,

R_{221} to R_{223} may each independently be selected from a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, and a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group, and at least one selected from R_{221} to R_{223} may have at least one substituent selected from a cyano group, -F, -Cl, -Br, -I, a C_1-C_{20} alkyl group substituted with -F, a C_1-C_{20} alkyl group substituted with -Cl, a C_1-C_{20} alkyl group substituted with -Br, and a C_1-C_{20} alkyl group substituted with -I.

[0119] The hole transport region 12 may have a thickness of about 100 Å to about 10000 Å, for example, about 400 Å to about 2000 Å, and the emission layer 15 may have a thickness of about 100 Å to about 3000 Å, for example, about 300 Å to about 1000 Å. When the thickness of each of the hole transport region 12 and the emission layer 15 is within these ranges described above, satisfactory hole transportation characteristics and/or luminescent characteristics may be obtained without a substantial increase in driving voltage.

[Electron transport region 17]

[0120] The electron transport region 17 is placed between the emission layer 15 and the second electrode 19 of the organic light-emitting device 10.

[0121] The electron transport region 17 may have a single-layered structure or a multi-layered structure.

[0122] For example, the electron transport region 17 may have an electron transport layer, an electron transport layer/electron injection layer structure, a buffer layer/electron transport layer structure, hole blocking layer/electron transport layer structure, a buffer layer/electron transport layer/electron injection layer structure, or a hole blocking layer/electron transport layer/electron injection layer structure, but embodiments of the present disclosure are not limited thereto. The electron transport region 17 may further include an electron control layer.

[0123] The electron transport region 17 may include known electron transport materials.

[0124] The electron transport region (for example, a buffer layer, a hole blocking layer, an electron control layer, or an electron transport layer in the electron transport region) may include a metal-free compound containing at least one π electron-deficient nitrogen-containing cyclic group. The π electron-deficient nitrogen-containing cyclic group is the same as described above.

[0125] For example, the electron transport region may include a compound represented by Formula 601 below:

<Formula 601> $[Ar_{601}]_{xe11}$-$[(L_{601})_{xe1}$-$R_{601}]_{xe21}$

[0126] In Formula 601,
Ar_{601} and L_{601} may each independently be a substituted or unsubstituted C_5-C_{60} carbocyclic group or a substituted or unsubstituted C_1-C_{60} heterocyclic group,
xe11 may be 1, 2, or 3,
xe1 may be an integer from 0 to 5,
R_{601} may be selected from a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group, $-Si(Q_{601})(Q_{602})(Q_{603})$, $-C(=O)(Q_{601})$, $-S(=O)2(Q_{601})$, and $-P(=O)(Q_{601})(Q_{602})$,
Q_{601} to Q_{603} may each independently be a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, or a naphthyl group, and xe21 may be an integer from 1 to 5.

[0127] In one embodiment, at least one of Ar_{601}(s) in the number of xe11 and R_{601}(s) in the number of xe21 may include the π electron-deficient nitrogen-containing cyclic group.

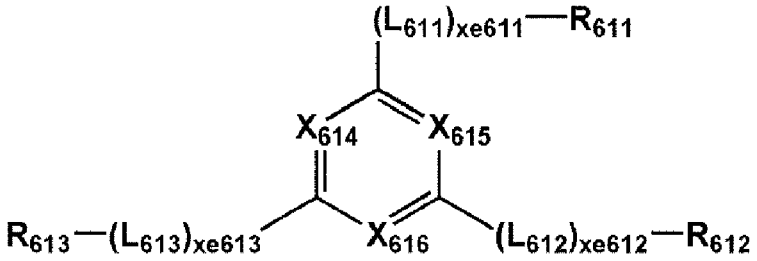
[0128] In one embodiment, ring Ar_{601} and L_{601} in Formula 601 may each independently be selected from a benzene group, a naphthalene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentaphene group, an indenoanthracene group, a dibenzofuran group, a dibenzothiophene group, a carbazole group, an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyrimidine group, a pyridazine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, and an azacarbazole group, each unsubstituted or substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, $-Si(Q_{31})(Q_{32})(Q_{33})$, $-S(=O)_2(Q_{31})$, and $-P(=O)(Q_{31})(Q_{32})$,
wherein Q_{31} to Q_{33} may each independently be selected from a C_1-C_{10} alkyl group, a C_1-C_{10} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, and a naphthyl group.

[0129] When xe11 in Formula 601 is 2 or more, two or more Ar_{601}(s) may be linked to each other via a single bond.

[0130] In one or more embodiments, Ar_{601} in Formula 601 may be an anthracene group.

[0131] In one or more embodiments, the compound represented by Formula 601 may be represented by Formula 601-1:

<Formula 601-1>



[0132] In Formula 601-1,
X_{614} may be N or $C(R_{614})$, X_{615} may be N or $C(R_{615})$, X_{616} may be N or $C(R_{616})$, and at least one selected from X_{614} to X_{616} may be N,
L_{611} to L_{613} may each independently be the same as described in connection with L_{601},
xe611 to xe613 may each independently be the same as described in connection with xe1,
R_{611} to R_{613} may each independently be the same as described in connection with R_{601}, and
R_{614} to R_{616} may each independently be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazino group, a hydrazono group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy

group, a phenyl group, a biphenyl group, a terphenyl group, and a naphthyl group.

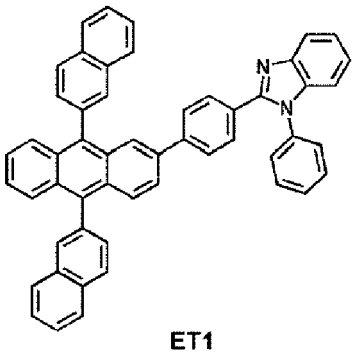
[0133] In one or more embodiments, xe1 and xe611 to xe613 in Formulae 601 and 601-1 may each independently be 0, 1, or 2.

[0134] In one or more embodiments, R_{601} and R_{611} to R_{613} in Formulae 601 and 601-1 may each independently be selected from a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a fluoranthenyl group, a triphenylenyl group, a pyrenyl group, a chrysenyl group, a perylenyl group, a pentaphenyl group, a hexacenyl group, a pentacenyl group, a thiophenyl group, a furanyl group, a carbazolyl group, an indolyl group, an isoindolyl group, a benzofuranyl group, a benzothiophenyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a benzocarbazolyl group, a dibenzocarbazolyl group, a dibenzosilolyl group, a pyridinyl group, an imidazolyl group, a pyrazolyl group, a thiazolyl group, an isothiazolyl group, an oxazolyl group, an isoxazolyl group, a thiadiazolyl group, an oxadiazolyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a triazinyl group, a quinolinyl group, an isoquinolinyl group, a benzoquinolinyl group, a phthalazinyl group, a naphthyridinyl group, a quinoxalinyl group, a quinazolinyl group, a cinnolinyl group, a phenanthridinyl group, an acridinyl group, a phenanthrolinyl group, a phenazinyl group, a benzimidazolyl group, an isobenzothiazolyl group, a benzoxazolyl group, an isobenzoxazolyl group, a triazolyl group, a tetrazolyl group, an imidazopyridinyl group, an imidazopyrimidinyl group, and an azacarbazolyl group, each unsubstituted or substituted with at least one selected from deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{20} alkyl group, a C_1-C_{20} alkoxy group, a phenyl group, a biphenyl group, a terphenyl group, a naphthyl group, a fluorenyl group, a spiro-bifluorenyl group, a benzofluorenyl group, a dibenzofluorenyl group, a phenanthrenyl group, an anthracenyl group, a fluoranthenyl group, a triphenylenyl group, a pyrenyl group, a chrysenyl group, a perylenyl group, a pentaphenyl group, a hexacenyl group, a pentacenyl group, a thiophenyl group, a furanyl group, a carbazolyl group, an indolyl group, an isoindolyl group, a benzofuranyl group, a benzothiophenyl group, a dibenzofuranyl group, a dibenzothiophenyl group, a benzocarbazolyl group, a dibenzocarbazolyl group, a dibenzosilolyl group, a pyridinyl group, an imidazolyl group, a pyrazolyl group, a thiazolyl group, an isothiazolyl group, an oxazolyl group, an isoxazolyl group, a thiadiazolyl group, an oxadiazolyl group, a pyrazinyl group, a pyrimidinyl group, a pyridazinyl group, a triazinyl group, a quinolinyl group, an isoquinolinyl group, a benzoquinolinyl group, a phthalazinyl group, a naphthyridinyl group, a quinoxalinyl group, a quinazolinyl group, a cinnolinyl group, a phenanthridinyl group, an acridinyl group, a phenanthrolinyl group, a phenazinyl group, a benzimidazolyl group, an isobenzothiazolyl group, a benzoxazolyl group, an isobenzoxazolyl group, a triazolyl group, a tetrazolyl group, an imidazopyridinyl group, an imidazopyrimidinyl group, and an azacarbazolyl group; and

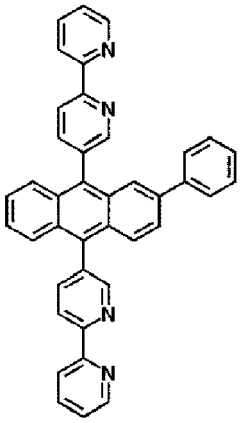
$-S(=O)_2(Q_{601})$ and $-P(=O)(Q_{601})(Q_{602})$,

wherein Q_{601} and Q_{602} are the same as described above.

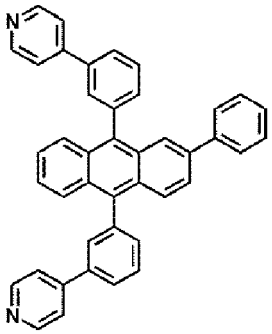
[0135] The electron transport region may include at least one compound selected from Compounds ET1 to ET36, but embodiments of the present disclosure are not limited thereto:



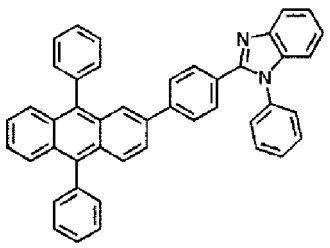
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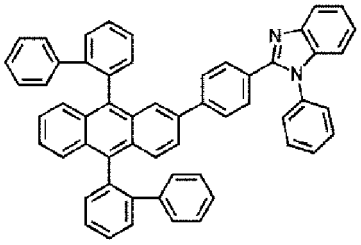
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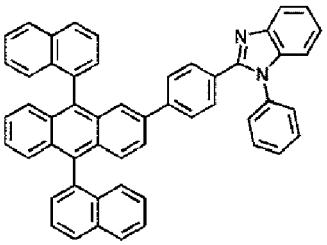
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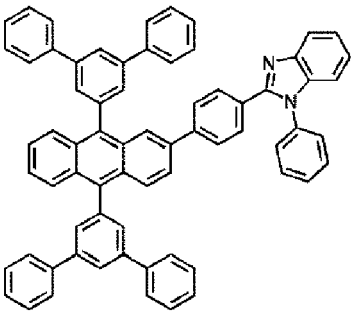
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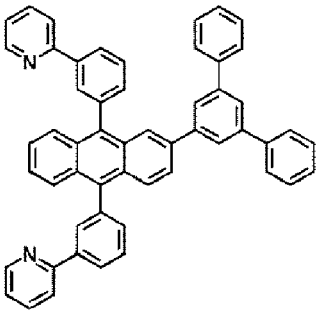
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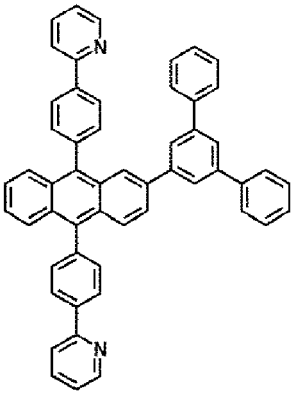
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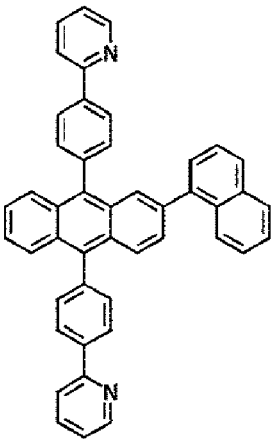
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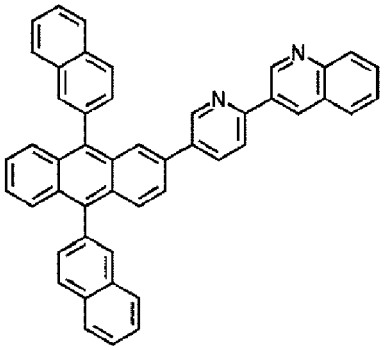
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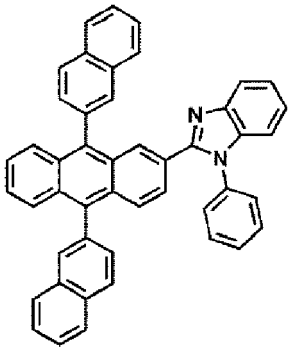
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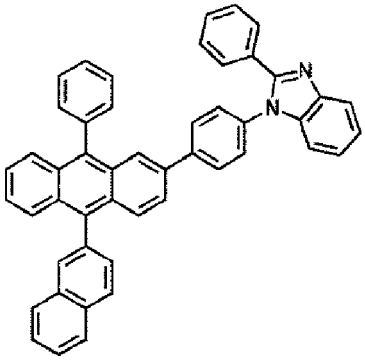
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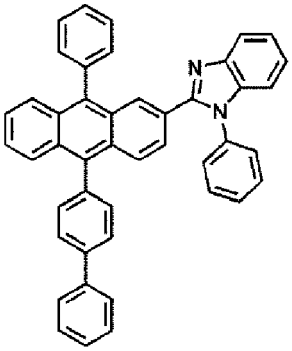
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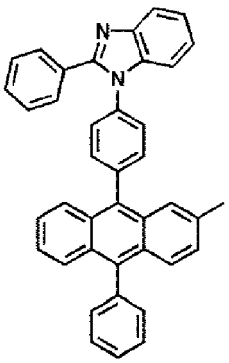
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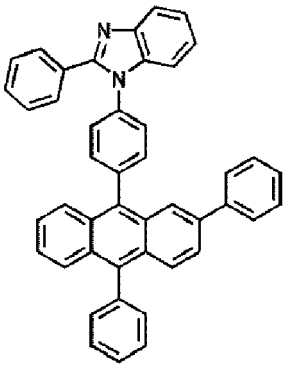
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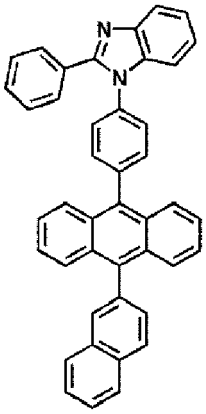
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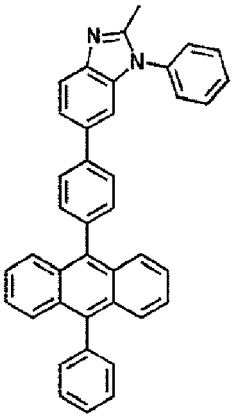
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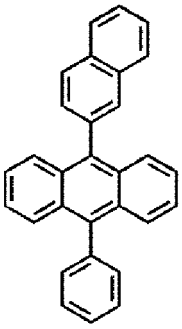
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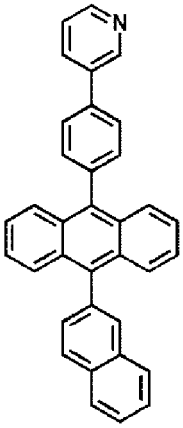
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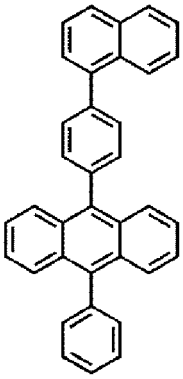
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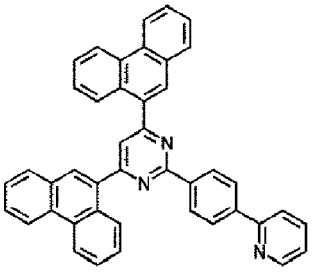
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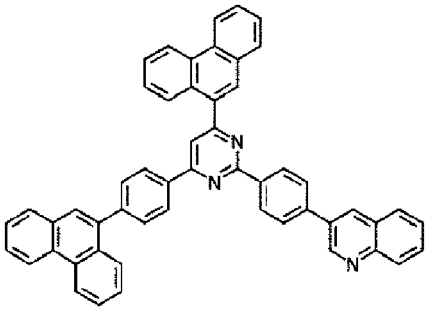
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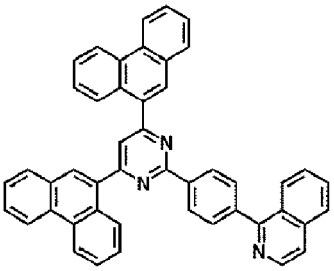
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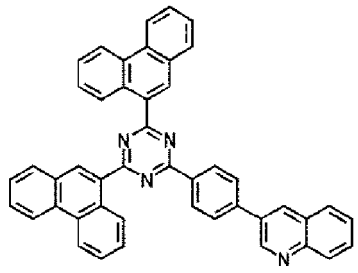
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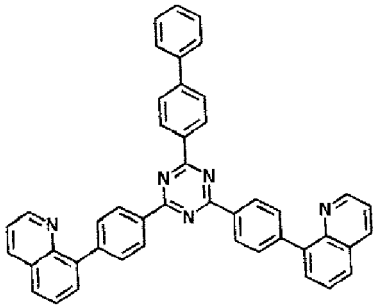
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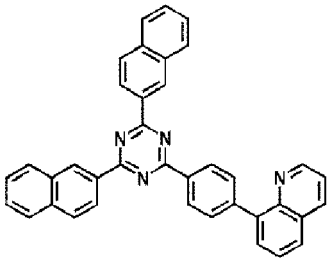
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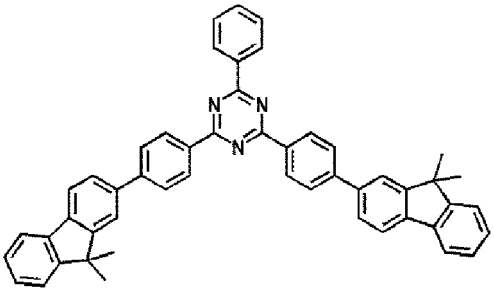
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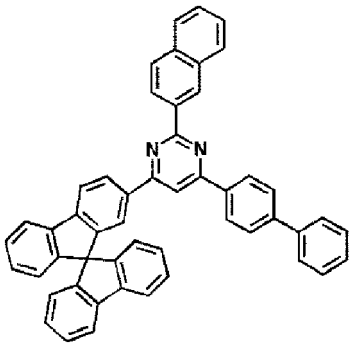
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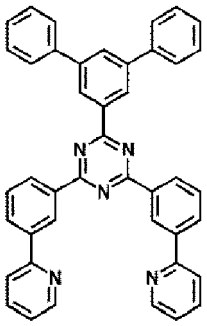
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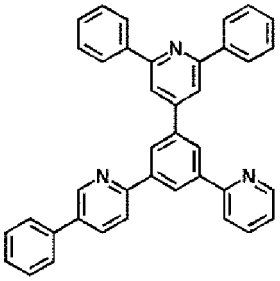
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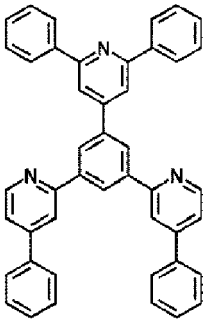
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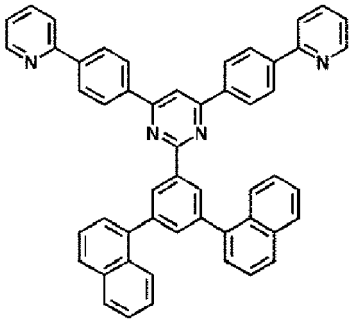
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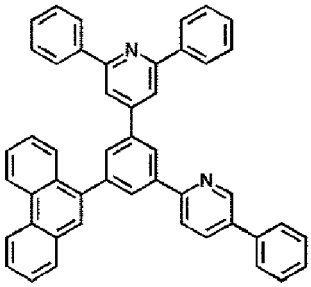
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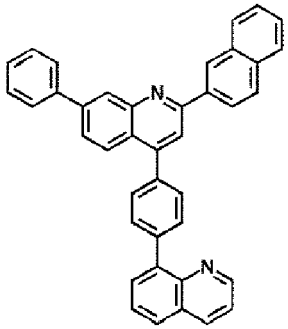
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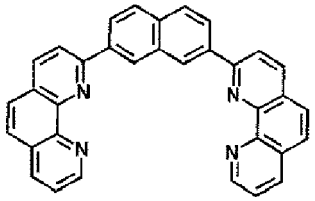
ET33



ET34

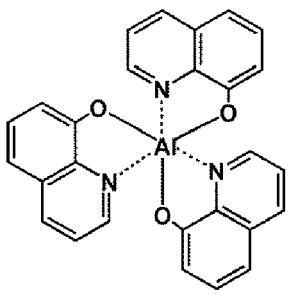


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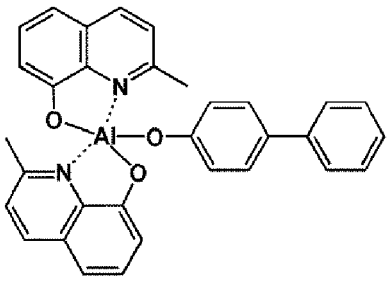


ET36

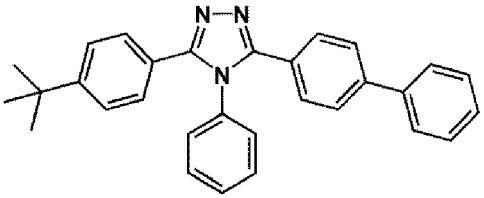
[0136] In one or more embodiments, the electron transport region may include at least one selected from 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (BCP), 4,7-dphenyl-1,10-phenanthroline (Bphen), Alq_3, BAlq, 3-(biphenyl-4-yl)-5-(4-tert-butylphenyl)-4-phenyl-4H-1,2,4-triazole (TAZ), and NTAZ:



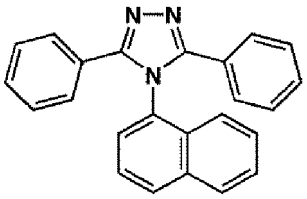
Alq_3



BAlq



TAZ



NTAZ

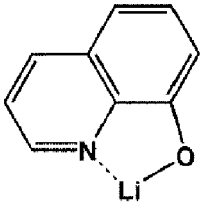
[0137] Thicknesses of the buffer layer, the hole blocking layer, and the electron control layer may each independently be in a range of about 20 Å to about 1,000 Å, for example, about 30 Å to about 300 Å. When the thicknesses of the buffer layer, the hole blocking layer, and the electron control layer are within these ranges, excellent hole blocking characteristics or excellent electron control characteristics may be obtained without a substantial increase in driving voltage.

[0138] A thickness of the electron transport layer may be in a range of about 100 Å to about 1,000 Å, for example, about 150 Å to about 500 Å. When the thickness of the electron transport layer is within the range described above, the electron transport layer may have satisfactory electron transport characteristics without a substantial increase in driving voltage.

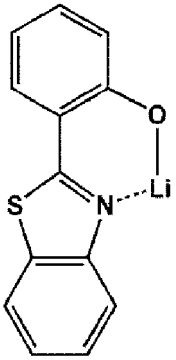
[0139] The electron transport region 17 (for example, the electron transport layer in the electron transport region) may further include, in addition to the materials described above, a metal-containing material.

[0140] The metal-containing material may include at least one selected from alkali metal complex and alkaline earth-metal complex. The alkali metal complex may include a metal ion selected from a Li ion, a Na ion, a K ion, a Rb ion, and a Cs ion, and the alkaline earth-metal complex may include a metal ion selected from a Be ion, a Mg ion, a Ca ion, a Sr ion, and a Ba ion. A ligand coordinated with the metal ion of the alkali metal complex or the alkaline earth-metal complex may be selected from a hydroxy quinoline, a hydroxy isoquinoline, a hydroxy benzoquinoline, a hydroxy acridine, a hydroxy phenanthridine, a hydroxy phenyloxazole, a hydroxy phenylthiazole, a hydroxy diphenyloxadiazole, a hydroxy diphenylthiadiazole, a hydroxy phenylpyridine, a hydroxy phenylbenzimidazole, a hydroxy phenylbenzothiazole, a bipyridine, a phenanthroline, and a cyclopentadiene, but embodiments of the present disclosure are not limited thereto.

[0141] For example, the metal-containing material may include a Li complex. The Li complex may include, for example, Compound ET-D1 (lithium quinolate, LiQ) or ET-D2:



ET-D1



ET-D2

[0142] The electron transport region 17 may include an electron injection layer that facilitates injection of electrons

from the second electrode 19. The electron injection layer may directly contact the second electrode 19.

[0143] The electron injection layer may have i) a single-layered structure including a single layer including a single material, ii) a single-layered structure including a single layer including a plurality of different materials, or iii) a multi-layered structure having a plurality of layers including a plurality of different materials.

[0144] The electron injection layer may include an alkali metal, an alkaline earth metal, a rare earth metal, an alkali metal compound, an alkaline earth-metal compound, a rare earth metal compound, an alkali metal complex, an alkaline earth-metal complex, a rare earth metal complex, or any combinations thereof.

[0145] The alkali metal may be selected from Li, Na, K, Rb, and Cs. In one embodiment, the alkali metal may be Li, Na, or Cs. In one or more embodiments, the alkali metal may be Li or Cs, but embodiments of the present disclosure are not limited thereto.

[0146] The alkaline earth metal may be selected from Mg, Ca, Sr, and Ba.

[0147] The rare earth metal may be selected from Sc, Y, Ce, Tb, Yb, and Gd.

[0148] The alkali metal compound, the alkaline earth-metal compound, and the rare earth metal compound may be selected from oxides and halides (for example, fluorides, chlorides, bromides, or iodides) of the alkali metal, the alkaline earth-metal, and the rare earth metal.

[0149] The alkali metal compound may be selected from alkali metal oxides, such as Li_2O, Cs_2O, or K_2O, and alkali metal halides, such as LiF, NaF, CsF, KF, LiI NaI, CsI or KI In one embodiment, the alkali metal compound may be selected from LiF, Li_2O, NaF, LiI NaI CsI and KI but embodiments of the present disclosure are not limited thereto.

[0150] The alkaline earth-metal compound may be selected from alkaline earth-metal oxides, such as BaO, SrO, CaO, $Ba_xSr_{1-x}O$ ($0<x<1$), or $Ba_xCa_{1-x}O$ ($0<x<1$). In one embodiment, the alkaline earth-metal compound may be selected from BaO, SrO, and CaO, but embodiments of the present disclosure are not limited thereto.

[0151] The rare earth metal compound may be selected from YbF_3, ScF_3, ScO_3, SC_2O3, Y_2O3, Ce_2O_3, GdF_3, and TbF_3. In one embodiment, the rare earth metal compound may be selected from YbF_3, ScF_3, TbF_3, YbI_3, ScI_3, and TbI_3, but embodiments of the present disclosure are not limited thereto.

[0152] The alkali metal complex, the alkaline earth-metal complex, and the rare earth metal complex may include an ion of alkali metal, alkaline earth-metal, and rare earth metal as described above, and a ligand coordinated with a metal ion of the alkali metal complex, the alkaline earth-metal complex, or the rare earth metal complex may be selected from hydroxy quinoline, hydroxy isoquinoline, hydroxy benzoquinoline, hydroxy acridine, hydroxy phenanthridine, hydroxy phenyloxazole, hydroxy phenylthiazole, hydroxy diphenyloxadiazole, hydroxy diphenylthiadiazole, hydroxy phenylpyridine, hydroxy phenylbenzimidazole, hydroxy phenylbenzothiazole, bipyridine, phenanthroline, and cyclopentadiene, but embodiments of the present disclosure are not limited thereto.

[0153] The electron injection layer may consist of an alkali metal, an alkaline earth metal, a rare earth metal, an alkali metal compound, an alkaline earth-metal compound, a rare earth metal compound, an alkali metal complex, an alkaline earth-metal complex, a rare earth metal complex, or any combinations thereof, as described above. In one or more embodiments, the electron injection layer may further include an organic material. When the electron injection layer further includes an organic material, an alkali metal, an alkaline earth metal, a rare earth metal, an alkali metal compound, an alkaline earth-metal compound, a rare earth metal compound, an alkali metal complex, an alkaline earth-metal complex, a rare earth metal complex, or any combinations thereof may be homogeneously or non-homogeneously dispersed in a matrix including the organic material.

[0154] A thickness of the electron injection layer may be in a range of about 1 Å to about 100 Å, for example, about 3 Å to about 90 Å. When the thickness of the electron injection layer is within the range described above, the electron injection layer may have satisfactory electron injection characteristics without a substantial increase in driving voltage.

[Second electrode 19]

[0155] The second electrode 19 is located on the organic layer 10A having such a structure. The second electrode 19 may be a cathode which is an electron injection electrode, and in this regard, a material for forming the second electrode 19 may be selected from a metal, an alloy, an electrically conductive compound, and a combination thereof, which have a relatively low work function.

[0156] The second electrode 19 may include at least one selected from lithium (Li), silver (Ag), magnesium (Mg), aluminum (Al), aluminum-lithium (Al-Li), calcium (Ca), magnesium-indium (Mg-In), magnesium-silver (Mg-Ag), ITO, and IZO, but embodiments of the present disclosure are not limited thereto. The second electrode 19 may be a transmissive electrode, a semi-transmissive electrode, or a reflective electrode.

[0157] The second electrode 19 may have a single-layered structure having a single layer or a multi-layered structure including two or more layers.

[0158] Hereinbefore, the organic light-emitting device has been described with reference to FIGURE, but embodiments of the present disclosure are not limited thereto.

[Description of FIG. 3]

[0159] FIG. 3 is a schematic cross-sectional view of an organic light-emitting device 100 according to another embodiment.

[0160] The organic light-emitting device 100 of FIG. 3 includes a first electrode 110, a second electrode 190 facing the first electrode 110, and a first emission unit 151 and a second emission unit 152 between the first electrode 110 and the second electrode 190. A charge generating layer 141 is located between the first emission unit 151 and the second emission unit 152, and the charge generating layer 141 may include an n-type charge generating layer 141-N and a p-type charge generating layer 141-P. The charge generating layer 141 is a layer that generates charge and supplies the charge to neighboring emission units, and any known material may be used therefor.

[0161] The first emission unit 151 may include a first emission layer 151-EM, and the second emission unit 152 may include a second emission layer 152-EM. The maximum emission wavelength of light emitted from the first emission unit 151 may be different from the maximum emission wavelength of light emitted from the second emission unit 152. For example, the mixed light of the light emitted from the first emission unit 151 and the light emitted from the second emission unit 152 may be white light, but embodiments of the present disclosure are not limited thereto.

[0162] The hole transport region 120 is located between the first emission unit 151 and the first electrode 110, and the second emission unit 152 may include the first hole transport region 121 located on the side of the first electrode 110 .

[0163] An electron transport region 170 is located between the second emission unit 152 and the second electrode 190, and the first emission unit 151 may include a first electron transport region 171 located between the charge generating layer 141 and the first emission layer 151-EM.

[0164] The first emission layer 151-EM may include a host, a cooling dopant, and a sensitizer, and the cooling dopant and the sensitizer may satisfy Conditions 1 and 2.

[0165] The second emission layer 152-EM may include a host, a cooling dopant, and a sensitizer, and the cooling dopant and the sensitizer may satisfy Conditions 1 and 2.

[0166] The first electrode 110 and the second electrode 190 illustrated in FIG. 3 may be the same as described in connection with the first electrode 11 and the second electrode 19 illustrated in FIG. 1.

[0167] The first emission layer 151-EM and the second emission layer 152-EM illustrated in FIG. 3 are each the same as described in connection with the emission layer 15 illustrated in FIG. 1.

[0168] The hole transport region 120 and the first hole transport region 121 illustrated in FIG. 3 are each the same as described in connection with the hole transport region 12 illustrated in FIG. 1.

[0169] The electron transport region 170 and the first electron transport region 171 illustrated in FIG. 3 are each the same as described in connection with the electron transport region 17 illustrated in FIG. 1.

[0170] As described above, referring to FIG. 3, an organic light-emitting device in which each of the first emission unit 151 and the second emission unit 152 includes an emission layer including a host, a cooling dopant, and a sensitizer, has been described. However, the organic light-emitting device may have various other forms. For example, one of the first emission unit 151 and the second emission unit 152 of the organic light-emitting device 100 of FIG. 3 may be replaced with any known emission unit, or may include three or more emission units.

[Description of FIG. 4]

[0171] FIG. 4 is a schematic cross-sectional view of an organic light-emitting device 200 according to another embodiment.

[0172] The organic light-emitting device 200 includes a first electrode 210, a second electrode 290 facing the first electrode 210, and a first emission layer 251 and a second emission layer 252 which are stacked between the first electrode 210 and the second electrode 290.

[0173] The maximum emission wavelength of light emitted from the first emission layer 251 may be different from the maximum emission wavelength of light emitted from the second emission layer 252. For example, the mixed light of the light emitted from the first emission layer 251 and the light emitted from the second emission layer 252 may be white light, but embodiments of the present disclosure are not limited thereto.

[0174] In one or more embodiments, a hole transport region 220 may be located between the first emission layer 251 and the first electrode 210, and an electron transport region 270 may be located between the second emission layer 252 and the second electrode 290.

[0175] The first emission layer 251 may include a host, a cooling dopant, and a sensitizer, and the cooling dopant and the sensitizer may satisfy Conditions 1 and 2.

[0176] The second emission layer 252 may include a host, a cooling dopant, and a sensitizer, and the cooling dopant and the sensitizer may satisfy Conditions 1 and 2.

[0177] The first electrode 210, the hole transport region 220, and the second electrode 290 illustrated in FIG. 4 are respectively the same as described in connection with the first electrode 11, the hole transport region 12, and the second

electrode 19 illustrated in FIG. 1.

[0178] The first emission layer 251 and the second emission layer 252 illustrated in FIG. 4 are each the same as described in connection with the emission layer 15 illustrated in FIG. 1.

[0179] The electron transport region 270 illustrated in FIG. 4 may be the same as described in connection with the electron transport region 17 in FIG. 1.

[0180] As described above, referring to FIG. 4, an organic light-emitting device, in which each of the first emission layer 251 and the second emission layer 252 includes a host, a cooling dopant, and a sensitizer, has been described. However, the organic light-emitting device may have various other forms. For example, one of the first emission layer 251 and the second emission layer 252 of the organic light-emitting device 200 of FIG. 4 may be replaced with any known emission layer, or an interlayer may be additionally located between neighboring emission layers.

Explanation of terms

[0181] The term "C_1-C_{60} alkyl group" as used herein refers to a linear or branched saturated aliphatic hydrocarbon monovalent group having 1 to 60 carbon atoms, and examples thereof include a methyl group, an ethyl group, a propyl group, an isobutyl group, a sec-butyl group, a tert-butyl group, a pentyl group, an isoamyl group, and a hexyl group. The term "C_1-C_{60} alkylene group" as used herein refers to a divalent group having the same structure as the C_1-C_{60} alkyl group.

[0182] The term "C_1-C_{60} alkoxy group" used herein refers to a monovalent group represented by -OA_{101} (wherein A_{101} is the C_1-C_{60} alkyl group), and examples thereof include a methoxy group, an ethoxy group, and an isopropyloxy group.

[0183] The term "C_2-C_{60} alkenyl group" as used herein refers to a hydrocarbon group formed by substituting at least one carbon-carbon double bond in the middle or at the terminus of the C_2-C_{60} alkyl group, and examples thereof include an ethenyl group, a propenyl group, and a butenyl group. The term "C_2-C_{60} alkenylene group" as used herein refers to a divalent group having the same structure as the C_2-C_{60} alkenyl group.

[0184] The term "C_2-C_{60} alkynyl group" as used herein refers to a hydrocarbon group formed by substituting at least one carbon-carbon triple bond in the middle or at the terminus of the C_2-C_{60} alkyl group, and examples thereof include an ethynyl group, and a propynyl group. The term "C_2-C_{60} alkynylene group" as used herein refers to a divalent group having the same structure as the C_2-C_{60} alkynyl group.

[0185] The term "C_3-C_{10} cycloalkyl group" as used herein refers to a monovalent saturated hydrocarbon monocyclic group having 3 to 10 carbon atoms, and examples thereof include a cyclopropyl group, a cyclobutyl group, a cyclopentyl group, a cyclohexyl group, and a cycloheptyl group. The term "C_3-C_{10} cycloalkylene group" as used herein refers to a divalent group having the same structure as the C_3-C_{10} cycloalkyl group.

[0186] The term "C_1-C_{10} heterocycloalkyl group" as used herein refers to a monovalent saturated monocyclic group having at least one heteroatom selected from N, O, P, Si, and S as a ring-forming atom and 1 to 10 carbon atoms, and non-limiting examples thereof include a tetrahydrofuranyl group, and a tetrahydrothiophenyl group. The term "C_1-C_{10} heterocycloalkylene group" as used herein refers to a divalent group having the same structure as the C_1-C_{10} heterocycloalkyl group.

[0187] The term "C_3-C_{10} cycloalkenyl group" as used herein refers to a monovalent monocyclic group that has 3 to 10 carbon atoms and at least one carbon-carbon double bond in the ring thereof and no aromaticity, and non-limiting examples thereof include a cyclopentenyl group, a cyclohexenyl group, and a cycloheptenyl group. The term "C_3-C_{10} cycloalkenylene group" as used herein refers to a divalent group having the same structure as the C_3-C_{10} cycloalkenyl group.

[0188] The term "C_1-C_{10} heterocycloalkenyl group" as used herein refers to a monovalent monocyclic group that has at least one heteroatom selected from N, O, P, Si, and S as a ring-forming atom, 1 to 10 carbon atoms, and at least one carbon-carbon double bond in its ring. Examples of the C_1-C_{10} heterocycloalkenyl group are a 2,3-dihydrofuranyl group, and a 2,3-dihydrothiophenyl group. The term "C_1-C_{10} heterocycloalkenylene group" as used herein refers to a divalent group having the same structure as the C_1-C_{10} heterocycloalkenyl group.

[0189] The term "C_6-C_{60} aryl group" as used herein refers to a monovalent group having a carbocyclic aromatic system having 6 to 60 carbon atoms, and the term "C_6-C_{60} arylene group" as used herein refers to a divalent group having a carbocyclic aromatic system having 6 to 60 carbon atoms. Examples of the C_6-C_{60} aryl group include a phenyl group, a naphthyl group, an anthracenyl group, a phenanthrenyl group, a pyrenyl group, and a chrysenyl group. When the C_6-C_{60} aryl group and the C_6-C_{60} arylene group each include two or more rings, the rings may be fused to each other.

[0190] The term "C_1-C_{60} heteroaryl group" as used herein refers to a monovalent group having a heterocarbocyclic aromatic system that has at least one heteroatom selected from N, O, P, Si, and S as a ring-forming atom, and 1 to 60 carbon atoms. The term "C_1-C_{60} heteroarylene group" as used herein refers to a divalent group having a carbocyclic aromatic system that has at least one heteroatom selected from N, O, P, and S as a ring-forming atom, and 1 to 60 carbon atoms. Examples of the C_1-C_{60} heteroaryl group include a pyridinyl group, a pyrimidinyl group, a pyrazinyl group, a pyridazinyl group, a triazinyl group, a quinolinyl group, and an isoquinolinyl group. When the C_6-C_{60} heteroaryl group

and the C_6-C_{60} heteroarylene group each include two or more rings, the rings may be fused to each other.

[0191] The term "C_6-C_{60} aryloxy group" as used herein refers to -OA_{102} (wherein A_{102} is the C_6-C_{60} aryl group), and a C_6-C_{60} arylthio group used herein refers to -SA_{103} (wherein A_{103} is the C_6-C_{60} aryl group).

[0192] The term "monovalent non-aromatic condensed polycyclic group" used herein refers to a monovalent group in which two or more rings are condensed with each other, only carbon is used as a ring-forming atom (for example, the number of carbon atoms may be 8 to 60) and the whole molecule is a non-aromaticity group. Examples of the monovalent non-aromatic condensed polycyclic group include a fluorenyl group. The term "divalent non-aromatic condensed polycyclic group" as used herein refers to a divalent group having the same structure as the monovalent non-aromatic condensed polycyclic group.

[0193] The term "monovalent non-aromatic condensed heteropolycyclic group" as used herein refers to a monovalent group having two or more rings condensed to each other, a heteroatom selected from N, O, P, Si, and S, other than carbon atoms(for example, having 1 to 60 carbon atoms), as a ring-forming atom, and no aromaticity in its entire molecular structure. Examples of the monovalent non-aromatic condensed heteropolycyclic group include a carbazolyl group. The term "divalent non-aromatic condensed heteropolycyclic group" as used herein refers to a divalent group having the same structure as the monovalent non-aromatic condensed heteropolycyclic group.

[0194] The term "C_5-C_{30} carbocyclic group" as used herein refers to a saturated or unsaturated cyclic group having, as a ring-forming atom, 5 to 30 carbon atoms only. The C_5-C_{30} carbocyclic group may be a monocyclic group or a polycyclic group, and may be a monovalent, divalent, trivalent, tetravalent, pentavalent, or hexavalent group, depending on the formula structure.

[0195] The term "C_1-C_{30} heterocyclic group" as used herein refers to a saturated or unsaturated cyclic group having, as a ring-forming atom, at least one heteroatom selected from N, O, Si, P, and S other than 1 to 30 carbon atoms. The C_1-C_{30} heterocyclic group may be a monocyclic group or a polycyclic group, and may be a monovalent, divalent, trivalent, tetravalent, pentavalent, or hexavalent group, depending on the formula structure.

[0196] At least one substituent of the substituted C_5-C_{60} carbocyclic group, the substituted C_1-C_{60} heterocyclic group, the substituted C_1-C_{60} alkyl group, the substituted C_2-C_{60} alkenyl group, the substituted C_2-C_{60} alkynyl group, the substituted C_1-C_{60} alkoxy group, the substituted C_3-C_{10} cycloalkyl group, the substituted C_1-C_{10} heterocycloalkyl group, the substituted C_3-C_{10} cycloalkenyl group, the substituted C_1-C_{10} heterocycloalkenyl group, the substituted C_6-C_{60} aryl group, the substituted C_6-C_{60} aryloxy group, the substituted C_6-C_{60} arylthio group, the substituted C_1-C_{60} heteroaryl group, the substituted monovalent non-aromatic condensed polycyclic group, and the substituted monovalent non-aromatic condensed heteropolycyclic group may be selected from:

deuterium, -F, -Cl, -Br, -I, -CD_3, -CD_2H, -CDH_2, -CF_3, -CF_2H, -CFH_2, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, and a C_1-C_{60} alkoxy group;

a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, and a C_1-C_{60} alkoxy group, each substituted with at least one of deuterium, -F, -Cl, -Br, -I, -CD_3, -CD_2H, -CDH_2, -CF_3, -CF_2H, -CFH_2, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10} heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group, -$N(Q_{11})(Q_{12})$, -$Si(Q_{13})(Q_{14})(Q_{15})$, -$B(Q_{16})(Q_{17})$, and -$P(=O)(Q_{18})(Q_{19})$;

a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10} heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, and a monovalent non-aromatic condensed heteropolycyclic group;

a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10} heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, and a monovalent non-aromatic condensed heteropolycyclic group, each substituted with at least one of deuterium, -F, -Cl, -Br, -I, -CD_3, -CD_2H, -CDH_2, -CF_3, -CF_2H, -CFH_2, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10} heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group, -$N(Q_{21})(Q_{22})$, -$Si(Q_{23})(Q_{24})(Q_{25})$, -$B(Q_{26})(Q_{27})$, and -$P(=O)(Q_{28})(Q_{29})$; and

-$N(Q_{31})(Q_{32})$, -$Si(Q_{33})(Q_{34})(Q_{35})$, -$B(Q_{36})(Q_{37})$, and -$P(=O)(Q_{38})(Q_{39})$,

wherein Q_1 to Q_9, Q_{11} to Q_{19}, Q_{21} to Q_{29} and Q_{31} to Q_{39} may each independently be selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amino group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10}heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_6-C_{60} aryl group substituted with at least one selected from a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a monovalent non-aromatic condensed polycyclic group, and a monovalent non-aromatic condensed heteropolycyclic group.

[0197] The term "room temperature" used herein refers to a temperature of about 25°C.

[0198] The terms "a biphenyl group, a terphenyl group, and a tetraphenyl group" used herein respectively refer to monovalent groups in which two, three, or four phenyl groups which are linked together via a single bond.

[0199] The terms "a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, and a cyano-containing tetraphenyl group" used herein respectively refer to a phenyl group, a biphenyl group, a terphenyl group, and a tetraphenyl group, each of which is substituted with at least one cyano group. In "a cyano-containing phenyl group, a cyano-containing biphenyl group, a cyano-containing terphenyl group, and a cyano-containing tetraphenyl group", a cyano group may be substituted to any position of the corresponding group, and the "cyano-containing phenyl group, the cyano-containing biphenyl group, the cyano-containing terphenyl group, and the cyano-containing tetraphenyl group" may further include substituents other than a cyano group. For example, a phenyl group substituted with a cyano group, and a phenyl group substituted with a cyano group and a methyl group may all belong to "a cyano-containing phenyl group."

[0200] Hereinafter, a compound and an organic light-emitting device according to embodiments are described in detail with reference to Synthesis Examples and Examples. However, the organic light-emitting device is not limited thereto. The wording "'B' was used instead of 'A'" used in describing Synthesis Examples means that an amount of 'A' used was identical to an amount of 'B' used, in terms of a molar equivalent.

[Examples]

Evaluation Example 1: Decay time measurement

[0201] On the quartz substrate, compounds of Tables 5 to 7 were vacuum-codeposited at a vacuum degree of 10^{-7} torr at a weight ratio of Tables 5 to 7 to manufacture films, each having a thickness of 40 nm. With respect to each of the films, the PL spectrum was evaluated at room temperature by using FluoTime 300 of PicoQuant Inc. and PLS340, which is a pumping source of PicoQuant Inc., (excitation wavelength = 340 nm, and spectrum width = 20 nm). In detail, the wavelength of the main peak of the spectrum obtained for each film was identified, and the number of photons emitted from the respective sample at the wavelength of the main peak by photon pulses (pulse width = 500 ps) applied by the PLS340 to the respective film was repeatedly measured based on time-correlated single photon counting (TCSPC), to obtain a TRPL curve which can be subjected to fitting. Two or more exponential decay functions, obtained therefrom, were subjected to fitting to calculate a decay time with respect to each film. In this regard, the same measurement was performed for the same measurement time as used to obtain the TRPL curve in the dark condition (The light low pulse signal incident to the predetermined film was blocked) to obtain a background signal curve which was then subjected to fitting. The resultant was used as a baseline.

[0202] At this time, in the case of the film of Table 5, the function used for fitting is the same as Equation A below, and the largest value among the Taus obtained therefrom was taken. For the films of Tables 6 and 7 below, Tau was obtained by <Equation B> using the amplitude values (A_1, A_2, A_3, etc.) and Tau values (Tau_1, Tau_2, Tau_3, etc.) obtained by fitting:

<Equation A>

$$f(t) = \sum_{i=1}^{n} A_i \exp\left(-t/T_{decay,i}\right)$$

<Equation B>

$$Tau = \left(\sum_{i=1}^{n} A_i \times Tau_i\right) \div \left(\sum_{i=1}^{n} A_i\right)$$

[Table 5]

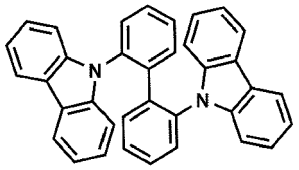
Film No.	Film composition (weight ratio)	Decay time(μs)
SP002ND	H-H1 : H-E1 : SP002 (45 : 45 : 10)	2.393
SP003ND	H-H1 : H-E1 : SP003 (45 : 45 : 10)	2.703
SP004ND	H-H1 : H-E1 : SP004 (45 : 45 : 10)	4.924
SP005ND	H-H1 : H-E1 : SP005 (45 : 45 : 10)	2.866
SP006ND	H-H1 : H-E1 : SP006 (45 : 45 : 10)	1.836
SP007ND	H-H1 : H-E1 : SP007 (45 : 45 : 10)	2.223
ST001 ND	H-H1 : H-E1 : ST001 (45 : 45 : 10)	1.13
ST002ND	H-H1 : H-E1 : ST002 (45 : 45 : 10)	2.69

Table 6

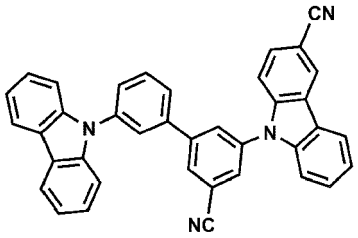
Film No.	Film composition (weight ratio)	Decay time(μs)
SP002D	H-H1 : H-E1 : SP002 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.363
SP003D	H-H1 : H-E1 : SP003 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.378
SP004D	H-H1 : H-E1 : SP004 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.269
SP005D	H-H1 : H-E1 : SP005 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.398
SP006D1	H-H1 : H-E1 : SP006 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.307
SP006D2	H-H1 : H-E1 : SP006 : FD5 (42.75 : 42.75 : 9.5 : 5)	0.634
SP007D1	H-H1 : H-E1 : SP007 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.413
SP007D2	H-H1 : H-E1 : SP007 : FD5 (42.75 : 42.75 : 9.5 : 5)	0.749
ST001 D1	H-H1 : H-E1 : ST001 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.012
ST001 D2	H-H1 : H-E1 : ST001 : FD5 (42.75 : 42.75 : 9.5 : 5)	0.09
ST002D1	H-H1 : H-E1 : ST002 : FD11 (42.75 : 42.75 : 9.5 : 5)	0.719
ST002D2	H-H1 : H-E1 : ST002 : FD5 (42.75 : 42.75 : 9.5 : 5)	0.673

Table 7

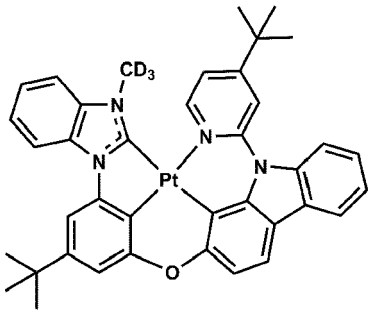
Film No.	Film composition (weight ratio)	Decay time(μs)
FD001	H-H1 : H-E1 : FD11 (47.5 : 47.5 : 5)	0.027
FD002	H-H1 : H-E1 : FD5 (47.5 : 47.5 : 5)	0.069



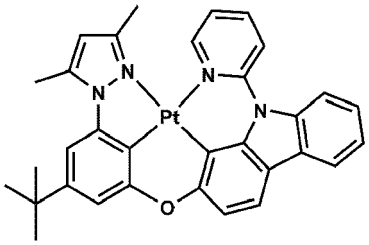
H-H1



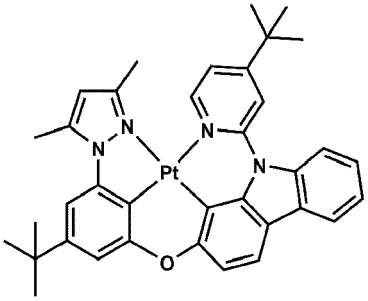
H-E1



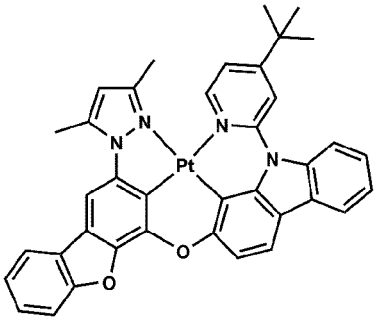
SP002



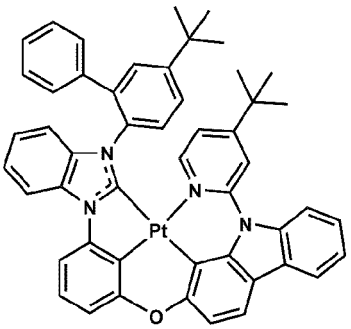
SP003



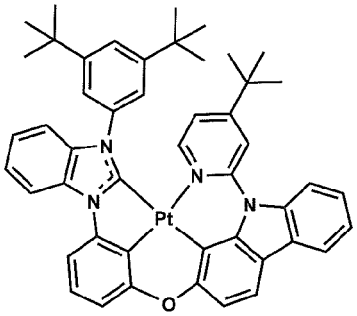
SP004



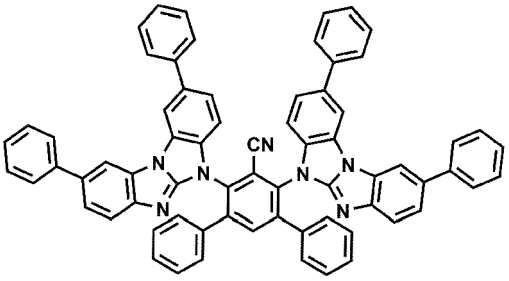
SP005



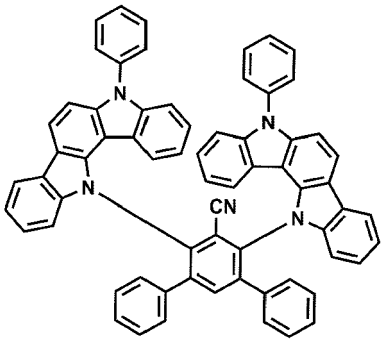
SP006



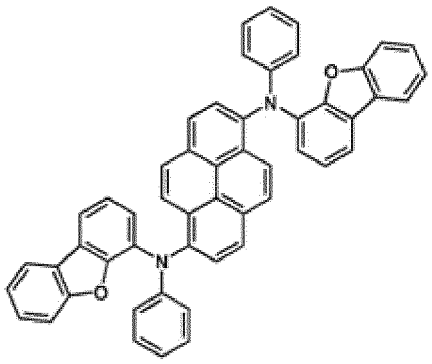
SP007



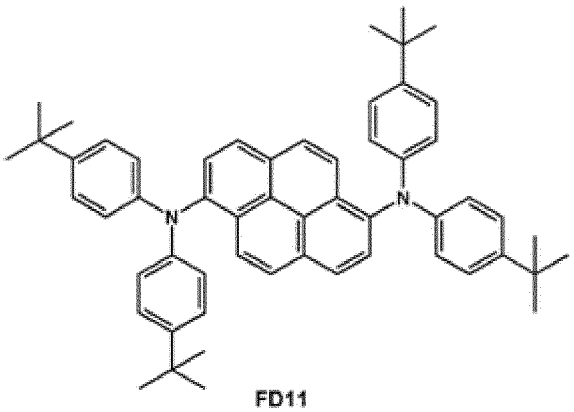
ST001



ST002



FD5



FD11

Example 1

[0203] An ITO glass substrate was cut to a size of 50 mm x 50 mm x 0.5 mm and then, sonicated in acetone isopropyl alcohol and pure water, each for 15 minutes, and then, washed by exposure to UV ozone for 30 minutes.

[0204] Then, F6-TCNNQ was deposited on the ITO electrode (anode) of the glass substrate to form a hole injection layer having a thickness of 100Å, and HT1 was deposited on the hole injection layer to form a hole transport layer having a thickness of 1260 Å, thereby completing a hole transport region.

[0205] Compound H-H1 (first host), H-E1 (second host), Compound SP002(sensitizer)(in this case, the weight ratio of the first host, the second host and the sensitizer was 45:45:10) and FD11 (cooling dopant)(in this case, the cooling dopant was 5 wt% based on the total weight of the first host, the second host, the sensitizer, and the cooling dopant) were co-deposited on the hole transport region to form an emission layer having a thickness of 400Å thickness.

[0206] Compound ET17 and Liq were co-deposited at the weight ratio of 5:5 on the emission layer to form an electron transport layer having a thickness of 360Å thickness, and then, LiQ was deposited on the electron transport layer to form an electron injection layer having a thickness of 5Å thickness, and Al was deposited on the electron injection layer to a thickness of 800Å, thereby completing of an organic light-emitting device.

Examples 2 to 12

[0207] Organic light-emitting devices were manufactured in the same manner as in Example 1, except that the sensitizers and the cooling dopants shown in Table 8 were used in forming an emission layer.

Table 8

	First host	Second host	Sensitizer	Cooling dopant
Example 1	H-H1	H-E1	SP002	FD11
Example 2	H-H1	H-E1	SP003	FD11
Example 3	H-H1	H-E1	SP004	FD11
Example 4	H-H1	H-E1	SP005	FD11
Example 5	H-H1	H-E1	SP006	FD11
Example 6	H-H1	H-E1	SP006	FD5
Example 7	H-H1	H-E1	SP007	FD11
Example 8	H-H1	H-E1	SP007	FD5
Example 9	H-H1	H-E1	ST001	FD11
Example 10	H-H1	H-E1	ST001	FD5
Example 11	H-H1	H-E1	ST002	FD11
Example 12	H-H1	H-E1	ST002	FD5

Comparative Example 1F and 2F

[0208] Organic light-emitting devices were manufactured in the same manner as in Example 1, except that, in forming an emission layer, a sensitizer was not used and the first host, the second host, and the cooling dopant were used as shown in Table 9.

Table 9

	First host	Second host	Cooling dopant	Weight ratio (first host: second host: cooling dopant)
Comparative Example 1F	H-H1	H-E1	FD11	47.5 : 47.5 : 5
Comparative Example 2F	H-H1	H-E1	FD5	47.5 : 47.5 : 5

Comparative Examples 1P to 6P

[0209] Organic light-emitting devices were manufactured in the same manner as in Example 1, except that, in forming an emission layer, a cooling dopant was not used and the first host, the second host, and the sensitizer were used as shown in Table 10.

Table 10

	First host	Second host	Sensitizer	Weight ratio (first host: second host: sensitizer)
Comparative Example 1P	H-H1	H-E1	SP002	45 : 45 : 10
Comparative Example 2P	H-H1	H-E1	SP003	45 : 45 : 10
Comparative Example 3P	H-H1	H-E1	SP004	45 : 45 : 10
Comparative Example 4P	H-H1	H-E1	SP005	45 : 45 : 10
Comparative Example 5P	H-H1	H-E1	SP006	45 : 45 : 10
Comparative Example 6P	H-H1	H-E1	SP007	45 : 45 : 10

Comparative Examples 1T and 2T

[0210] Organic light-emitting devices were manufactured in the same manner as in Example 1, except that, in forming an emission layer, a cooling dopant was not used and the first host, the second host, and the sensitizer were used as shown in Table 11.

Table 11

	First host	Second host	Sensitizer	Weight ratio (first host: second host: sensitizer)
Comparative Example 1T	H-H1	H-E1	ST001	45 : 45 : 10
Comparative Example 2T	H-H1	H-E1	ST002	45 : 45 : 10

Evaluation Example 2: OLED Lifespan and External Quantum Efficiency Measurements

[0211] The external quantum efficiency (EQE) and lifespan of each of organic light-emitting devices manufactured according to Examples 1 to 12 were evaluated, and then, the results are calculated as a relative value (%), and results thereof are shown in Table 12. As an evaluation apparatus, a luminance meter (Minolta Cs-1000A) was used. The lifespan (T_{95}) was determined by evaluating the time taken for 100% of initial luminance to be 95% thereof under the same luminance measurement conditions.

[0212] In addition, after measuring the lifespan and EQE of Example 3, Comparative Example 3P, 1F, and 2F, the

relative value (%) was calculated based on the value of Comparative Example 1F and the results are shown in Table 13, and FIGS. 5 and 6.

Table 12

	First host	Second host	Sensitizer	Cooling dopant	Lifespan (%)	EQE (%)
Example 1	H-H1	H-E1	SP002	FD11	688	181
Example 2	H-H1	H-E1	SP003	FD11	234	142
Example 3	H-H1	H-E1	SP004	FD11	296	121
Example 4	H-H1	H-E1	SP005	FD11	100	100
Example 5	H-H1	H-E1	SP006	FD11	1051	134
Example 6	H-H1	H-E1	SP006	FD5	340	102
Example 7	H-H1	H-E1	SP007	FD11	1355	144
Example 8	H-H1	H-E1	SP007	FD5	487	124
Example 9	H-H1	H-E1	ST001	FD11	43	65
Example 10	H-H1	H-E1	ST001	FD5	24	86
Example 11	H-H1	H-E1	ST002	FD11	232	129
Example 12	H-H1	H-E1	ST002	FD5	140	162

[0213] Referring to Table 12, it can be seen that the organic light-emitting device of Example 1 to 12 has long life span and high efficiency.

Table 13

	First host	Second host	Sensitizer	Cooling dopant	Lifespan (%)	EQE (%)
Example 3	H-H1	H-E1	SP004	FD11	296	121
Comparative Example 3P	H-H1	H-E1	SP004	-	13	86
Comparative Example 1F	H-H1	H-E1	-	FD11	66	31

[0214] Referring to Table 13, and FIGS. 5 and 6, it can be seen that the organic light-emitting device of Example 3 has a long lifespan and high EQE compared to a phosphorescent organic light-emitting device (Comparative Example 3P) and a fluorescent organic light-emitting device (Comparative Example 1F).

Evaluation Example 3: Calculation of OLED Lifespan Increase

[0215] For Examples 1 to 12 and Comparative Examples 1F and 2F, the time (T_{95}) taken for 100% of the initial luminance to be decreased to 95% thereof at 6000 nits was measured. Then, the lifespan increase of Example 1 to 12 was calculated using the following equation L and the results are shown in Table 14.

<Equation L>

$$\text{Lifespan increase of device A} = \{T_{95} \text{ of device A}\} / \{T_{95} \text{ of device B}\}$$

Table 14

Device A	Device B	Lifespan Increase of Device A
Example 1	Comparative Example 1F	5.8
Example 2	Comparative Example 1F	4.6

(continued)

Device A	Device B	Lifespan Increase of Device A
Example 3	Comparative Example 1F	22.3
Example 4	Comparative Example 1F	9.74
Example 5	Comparative Example 1F	5.70
Example 6	Comparative Example 2F	1.84
Example 7	Comparative Example 1F	4.17
Example 8	Comparative Example 2F	1.5
Example 9	Comparative Example 1F	11.3
Example 10	Comparative Example 2F	6.14
Example 11	Comparative Example 1F	5.74
Example 12	Comparative Example 2F	3.46

[0216] Referring to the Table 14, it can be seen that the organic light-emitting devices of Examples 1 to 12 have a significant improvement in lifespan compared to the fluorescent organic light-emitting devices of Comparative Examples 1F and 2F which do not include the sensitizer.

Evaluation Example 4: Calculation of OLED EQE Increase

[0217] For Examples 1 to 12, Comparative Examples 1P to 6P, and Comparative Examples 1T and 2T, external quantum efficiency (EQE) was measured. Then, the lifespan increase of Example 1 to 12 was calculated using the following equation E and the results are shown in Table 15.

<Equation E>

EQE increment of device C = {EQE of device C} / {EQE of device D}

Table 15

Device C	Device D	EQE increment of device C
Example 1	Comparative Example 1P	5.78
Example 2	Comparative Example 2P	4.52
Example 3	Comparative Example 3P	3.85
Example 4	Comparative Example 4P	3.19
Example 5	Comparative Example 5P	4.26
Example 6	Comparative Example 5P	1.66
Example 7	Comparative Example 6P	4.60
Example 8	Comparative Example 6P	2.02
Example 9	Comparative Example 1T	2.07
Example 10	Comparative Example 1T	1.40
Example 11	Comparative Example	4.11
	2T	
Example 12	Comparative Example 2T	2.62

[0218] Referring to the Table 15, it can be seen that the organic light-emitting devices of Examples 1 to 12 show a significant improvement in EQE compared to Comparative Examples 1P to 6P which do not include a cooling dopant, phosphorescence of 1T, and 2T, or TADF organic light-emitting devices.

[0219] The organic light-emitting device may have a long lifespan.

[0220] It should be understood that embodiments described herein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in other embodiments. While one or more embodiments have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the scope as defined by the following claims.

Claims

1. An organic light-emitting device comprising:

a first electrode; a second electrode; and an organic layer between the first electrode and the second electrode;
the organic layer comprises an emission layer;
the emission layer comprises a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer comprises platinum (Pt):

<Condition 1>

$T_{decay}(CD) < T_{decay}(S)$

<Condition 2>

$T_{decay}(CD) < 1.5\ \mu s$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

2. An organic light-emitting device comprising:

a first electrode; a second electrode; and an organic layer between the first electrode and the second electrode;
the organic layer comprises an emission layer;
the emission layer comprises a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer comprises a thermally activated delayed fluorescence emitter, and
the thermally activated delayed fluorescence emitter does not include metal:

<Condition 1>

$T_{decay}(CD) < T_{decay}(S)$

<Condition 2>

$T_{decay}(CD) < 1.5\ \mu s$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and

$T_{decay}(S)$ is a decay time of the sensitizer.

3. The organic light-emitting device of claim 1 or claim 2, wherein the organic light-emitting device further satisfies Condition 3:

<Condition 3>

$$T_{decay}(CD) / T_{decay}(S) < 0.5$$

wherein, in Condition 3,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer; and/or

wherein
the organic light-emitting device further satisfies Condition 4:

<Condition 4>

$$BDE(S) - T_1(S) < 3.0\ eV$$

wherein, in Condition 4,

BDE (S) is the bond dissociation energy level of the sensitizer, and
T1 (S) is the lowest excitation triplet energy level of the sensitizer; and/or

wherein
the organic light-emitting device further satisfies Condition 5:

<Condition 5>

$$R(Hex)/e^{10} < 15$$

wherein, in Condition 5,
R (Hex) is the production rate of hot excitons; and/or
wherein
the host, the dopant, and the sensitizer further satisfy Condition 6:

<Condition 6>

$$T_1(H) \geq T_1(S) \geq S_1(CD)$$

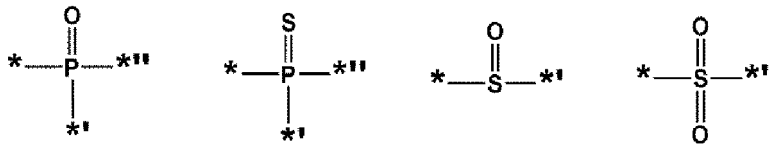
wherein, in Condition 6,

$T_1(H)$ is the lowest excitation triplet energy level of the host,
$T_1(S)$ is the lowest excitation triplet energy level of the sensitizer, and
$S_1(CD)$ is the lowest excitation singlet energy level of the cooling dopant.

4. The organic light-emitting device of any of claims 1-3, wherein
the emission layer consists of the host, the cooling dopant, and the sensitizer.

5. The organic light-emitting device of any of claims 1-4, wherein
the host comprises an amphiprotic host, an electron transport host, and/or a hole transport host,
the electron transport host comprises at least one electron transport moiety, the hole transport host does not include

an electron transport moiety,
the electron transport moiety is selected from a cyano group, a π electron-deficient nitrogen-containing cyclic group, and a group represented by one of the following Formulae:

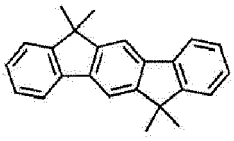


wherein *, *', and *" in the formulae above are each a binding site to a neighboring atom.

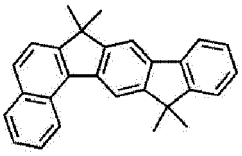
6. The organic light-emitting device of claim 5, wherein
the electron transport host comprises at least one π electron-deficient nitrogen-free cyclic group and at least one electron transport moiety,
the hole transport host comprises at least one π electron-deficient nitrogen-free cyclic group, and does not include an electron transport moiety, and
the electron transport moiety is a cyano group or an π-electron deficient nitrogen-containing cyclic group;
preferably wherein
the π electron-deficient nitrogen-containing cyclic group is selected from: an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyridazine group, a pyrimidine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, and an azacarbazole group; and a condensed cyclic group in which two or more π electron-deficient nitrogen-containing cyclic groups,
the π electron-deficient nitrogen-free cyclic group is selected from a benzene group, a heptalene group, an indene group, a naphthalene group, an azulene group, an indacene group, acenaphthylene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentacene group, a hexacene group, a pentaphene group, a rubicene group, a coronene group, an ovalene group, a pyrrole group, an isoindole group, an indole group, a furan group, a thiophene group, a benzofuran group, a benzothiophene group, a benzocarbazole group, a dibenzocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzothiophene sulfone group, a carbazole group, a dibenzosilole group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, a benzothienocarbazole group, a triindolobenzene group; and a condensed cyclic group of two or more π electron-deficient nitrogen-free cyclic groups.

7. The organic light-emitting device of claims 5 or 6, wherein
the electron transport host comprises i) at least one of a cyano group, a pyrimidine group, a pyrazine group, and a triazine group and ii) a triphenylene group, and
the hole transport host comprises a carbazole group.

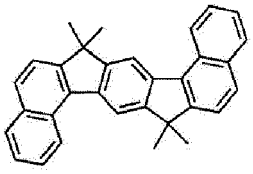
8. The organic light-emitting device of any of claims 1-7, wherein the maximum emission wavelength of the emission spectrum of the cooling dopant is 400 nm or more and 550 nm or less; and/or
wherein the cooling dopant does not include a metal atom; and/or
wherein
the cooling dopant comprises one of a naphthalene-containing core, a fluorene-containing core, a spiro-bifluorene-containing core, a benzofluorene-containing core, a dibenzofluorene-containing core, a phenanthrene-containing core, an anthracene-containing core, a fluoranthene-containing core, a triphenylene-containing core, a pyrene-containing core, a chrysene-containing core, a naphthacene-containing core, a picene-containing core, a perylene-containing core, a pentaphene-containing core, an indenoanthracene-containing core, a bisanthracene-containing core, and cores represented by Formulae 501-1 to 501-18:



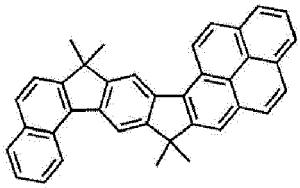
501-1



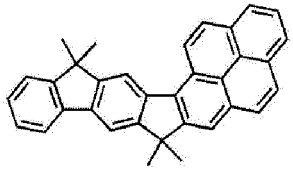
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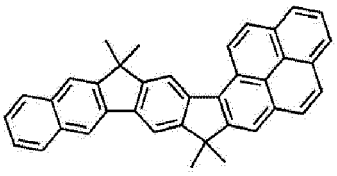
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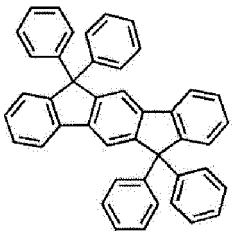
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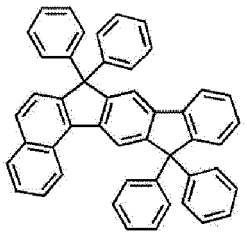
501-5



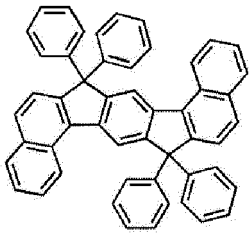
501-6



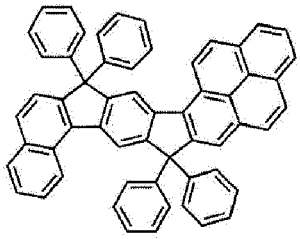
501-7



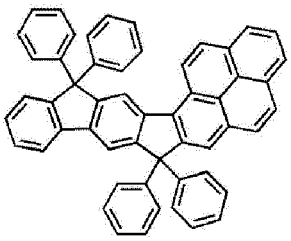
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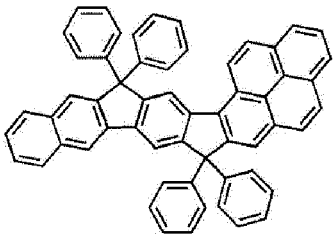
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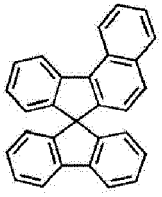
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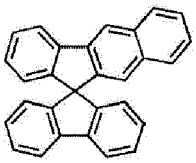
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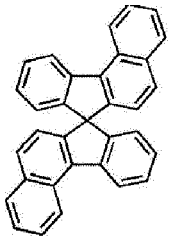
501-12



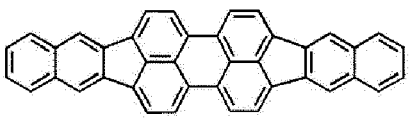
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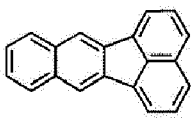
501-14



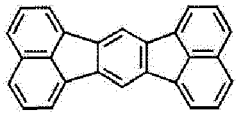
501-15



501-16



501-17



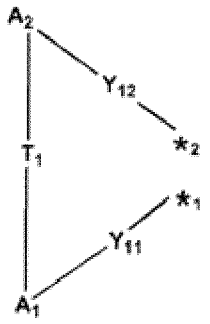
501-18

9. The organic light-emitting device of any of claims 1 or 3-8, wherein the sentizer comprises the organometallic compound represented by Formula 101:

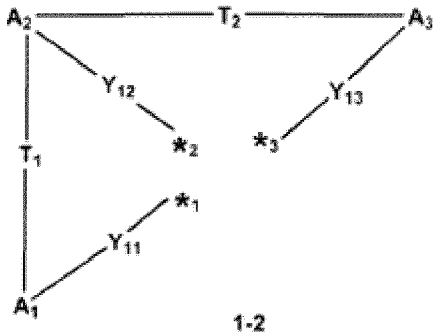
<Formula 101 > $Pt(L_{11})_{n11}(L_{12})_{n12}$

wherein, in Formula 101,

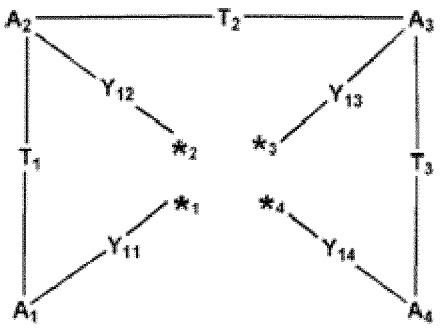
L_{11} is a ligand represented by one of Formulae 1-1 to 1-4;
L_{12} is selected from a monodentate ligand and a bidentate ligand;
n11 is1,
n12 is selected from 0, 1, and 2;



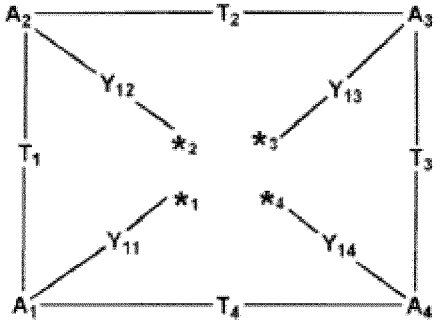
1-1



1-2



1-3



1-4

wherein, in Formulae 1-1 to 1-4,

A_1 to A_4 are each independently selected from a substituted or unsubstituted C_5-C_{30} carbocyclic group, a substituted or unsubstituted C_1-C_{30} heterocyclic group, and a non-cyclic group,
Y_{11} to Y_{14} are each independently a chemical bond, O, S, $N(R_{91})$, $B(R_{91})$, $P(R_{91})$, or $C(R_{91})(R_{92})$,
T_1 to T_4 are each independently selected from a single bond, a double bond, *-$N(R_{93})$-*', *-$B(R_{93})$-*', *-$P(R_{93})$-*', *-$C(R_{93})(R_{94})$-*', *-$Si(R_{93})(R_{94})$-*', *-$Ge(R_{93})(R_{94})$-*', *-S-*', *-Se-*', *-O-*', *-C(=O)-*', *-S(=O)-*', *-$S(=O)_2$-*', *-$C(R_{93})$=*', *=$C(R_{93})$-*', *-$C(R_{93})$=$C(R_{94})$-*', *-C(=S)-*', and *-C≡C-*',
a substituent of the substituted C_5-C_{30} carbocyclic group, a substituent of substituted C_1-C_{30} heterocyclic group, and R_{91} to R_{94} are each independently selected from hydrogen, deuterium, -F, -Cl, -Br, -I, $-SF_5$, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a carboxylic acid or a salt thereof, a sulfonic acid or a salt thereof, a phosphoric acid or a salt thereof, a substituted or unsubstituted C_1-C_{60} alkyl group, a substituted or unsubstituted C_2-C_{60} alkenyl group, a substituted or unsubstituted C_2-C_{60} alkynyl group, a substituted or unsubstituted C_1-C_{60} alkoxy group, a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10}heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, a substituted or unsubstituted monovalent non-aromatic condensed heteropolycyclic group,

$-Si(Q_1)(Q_2)(Q_3)$, $-B(Q_1)(Q_2)$, $-N(Q_1)(Q_2)$, $-P(Q_1)(Q_2)$, $-C(=O)(Q_1)$, $-S(=O)(Q_1)$, $-S(=O)_2(Q_1)$, $-P(=O)(Q_1)(Q_2)$, and $-P(=S)(Q_1)(Q_2)$, wherein each of a substituent of the substituted C_5-C_{30} carbocyclic group and a substituent of substituted C_1-C_{30} heterocyclic group is not hydrogen,

$*_1$, $*_2$, $*_3$, and $*_4$ each indicate a binding site to Pt, and

Q_1 to Q_3 are each independently selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10}heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_7-C_{60} alkyl aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a C_2-C_{60} alkyl heteroaryl group, a C_1-C_{60} heteroaryloxy group, a C_1-C_{60} heteroarylthio group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group, a C_1-C_{60} alkyl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group, and a C_6-C_{60} aryl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group.

10. The organic light-emitting device of any of claims 2-8, wherein the sensitizer satisfies Condition 7:

<Condition 7>

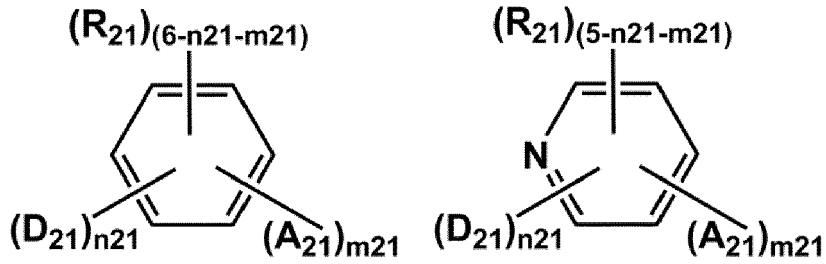
$$\Delta E_{ST} \leq 0.3 \text{ eV}$$

wherein, in Condition 7,

ΔE_{ST} is the difference between the lowest excitation singlet energy level and the lowest excitation triplet energy level of the sensitizer.

11. The organic light-emitting device of any of claims 2-8 or 10, wherein the sensitizer is represented by Formula 201 or 202:

<Formula 201> <Formula 202>



wherein, in Formulae 201 and 202,

A_{21} is an acceptor group,

D_{21} is a donor group,

m_{21} is1, 2, or 3, and n21 is1, 2, or 3,

the sum of n21 and m21 in Formula 201 is 6 or less, and the sum of n21 and m21 in Formula 202 is 5 or less,

R_{21} is selected from hydrogen, deuterium, -F, -Cl, -Br, -I, SF_5, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a substituted or unsubstituted C_1-C_{60} alkyl group, a substituted or unsubstituted C_2-C_{60} alkenyl group, a substituted or unsubstituted C_2-C_{60} alkynyl group, a substituted or unsubstituted C_1-C_{60} alkoxy group, a substituted or unsubstituted C_3-C_{10} cycloalkyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkyl group, a substituted or unsubstituted C_3-C_{10} cycloalkenyl group, a substituted or unsubstituted C_1-C_{10} heterocycloalkenyl group, a substituted or unsubstituted C_6-C_{60} aryl group, a substituted or unsubstituted C_7-C_{60} alkylaryl group, a substituted or unsubstituted C_6-C_{60} aryloxy group, a substituted or unsubstituted C_6-C_{60} arylthio group, a substituted or unsubstituted C_1-C_{60} heteroaryl group, a substituted or unsubstituted C_2-C_{60} alkylheteroaryl group, a substituted or unsubstituted C_1-C_{60}heteroaryloxy group, a substituted or unsubstituted C_1-C_{60} heteroarylthio group, a substituted or unsubstituted monovalent non-aromatic condensed polycyclic group, a substituted or unsubstituted monovalent non-aromatic condensed

heteropolycyclic group, -Si(Q_1)(Q_2)(Q_3), -B(Q_1)(Q_2), -N(Q_1)(Q_2), -P(Q_1)(Q_2), -C(=O)(Q_1), -S(=O)(Q_1), -S(=O)$_2$(Q_1), -P(=O)(Q_1)(Q_2), and -P(=S)(Q_1)(Q_2), a plurality of R_{21} are optionally linked together to form a substituted or unsubstituted C_5-C_{30} carbocyclic group or a substituted or unsubstituted C_1-C_{30} heterocyclic group,

Q_1 to Q_3 are each independently selected from hydrogen, deuterium, -F, -Cl, -Br, -I, a hydroxyl group, a cyano group, a nitro group, an amidino group, a hydrazine group, a hydrazone group, a C_1-C_{60} alkyl group, a C_2-C_{60} alkenyl group, a C_2-C_{60} alkynyl group, a C_1-C_{60} alkoxy group, a C_3-C_{10} cycloalkyl group, a C_1-C_{10} heterocycloalkyl group, a C_3-C_{10} cycloalkenyl group, a C_1-C_{10}heterocycloalkenyl group, a C_6-C_{60} aryl group, a C_7-C_{60} alkyl aryl group, a C_6-C_{60} aryloxy group, a C_6-C_{60} arylthio group, a C_1-C_{60} heteroaryl group, a C_2-C_{60} alkyl heteroaryl group, a C_1-C_{60} heteroaryloxy group, a C_1-C_{60} heteroarylthio group, a monovalent non-aromatic condensed polycyclic group, a monovalent non-aromatic condensed heteropolycyclic group, a C_1-C_{60} alkyl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group, and a C_6-C_{60} aryl group that is substituted with at least one selected from deuterium, -F, a cyano group, a C_1-C_{60} alkyl group, and a C_6-C_{60} aryl group;

preferably wherein

A_{21} is a substituted or unsubstituted π electron-deficient nitrogen-free cyclic group;

D_{21} is selected from:

-F, a cyano group, and a π-electron deficient nitrogen-containing cyclic group;

a C_1-C_{60} alkyl group, a π-electron deficient nitrogen-containing cyclic group, and a π electron-deficient nitrogen-free cyclic group, each substituted with at least one selected from -F and a cyano group; and

a π-electron deficient nitrogen-containing cyclic group, each substituted with at least one selected from deuterium, a C_1-C_{60} alkyl group, a π-electron deficient nitrogen-containing cyclic group, and a π electron-deficient nitrogen-free cyclic group;

the π electron-deficient nitrogen-free cyclic group is selected from a benzene group, a heptalene group, an indene group, a naphthalene group, an azulene group, an indacene group, acenaphthylene group, a fluorene group, a spiro-bifluorene group, a benzofluorene group, a dibenzofluorene group, a phenalene group, a phenanthrene group, an anthracene group, a fluoranthene group, a triphenylene group, a pyrene group, a chrysene group, a naphthacene group, a picene group, a perylene group, a pentacene group, a hexacene group, a pentaphene group, a rubicene group, a coronene group, an ovalene group, a pyrrole group, an isoindole group, an indole group, a furan group, a thiophene group, a benzofuran group, a benzothiophene group, a benzocarbazole group, a dibenzocarbazole group, a dibenzofuran group, a dibenzothiophene group, a dibenzothiophene sulfone group, a carbazole group, a dibenzosilole group, an indenocarbazole group, an indolocarbazole group, a benzofurocarbazole group, a benzothienocarbazole group, a triindolobenzene group; and a condensed cyclic group of two or more π electron-deficient nitrogen-free cyclic groups, and

the π electron-deficient nitrogen-containing cyclic group is a cyclic group having at least one *-N=*' moiety, and is selected from an imidazole group, a pyrazole group, a thiazole group, an isothiazole group, an oxazole group, an isoxazole group, a pyridine group, a pyrazine group, a pyridazine group, a pyrimidine group, an indazole group, a purine group, a quinoline group, an isoquinoline group, a benzoquinoline group, a phthalazine group, a naphthyridine group, a quinoxaline group, a quinazoline group, a cinnoline group, a phenanthridine group, an acridine group, a phenanthroline group, a phenazine group, a benzimidazole group, an isobenzothiazole group, a benzoxazole group, an isobenzoxazole group, a triazole group, a tetrazole group, an oxadiazole group, a triazine group, a thiadiazole group, an imidazopyridine group, an imidazopyrimidine group, an azacarbazole group, and a benzimidazolobenzimidazole group; and a condensed cyclic group of two or more π electron-eficient nitrogen-containing cyclic groups.

12. An organic light-emitting device comprising:

a first electrode; a second electrode; m emission units located between the first electrode and the second electrode and including at least one emission layer; and

m-1 charge generating layers between neighboring two emission units of the m emission units and including an n-type charge generating layer and a p-type charge generating layer,

m is an integer of 2 or more,

the maximum emission wavelength of light emitted from at least one emission unit of the m emission units is different from the maximum emission wavelength of light emitted from at least one emission unit of the remaining emission units,

the emission layer comprises a host, a cooling dopant, and a sensitizer, wherein

the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer comprises platinum (Pt):

<Condition 1>

$$T_{decay}(CD) < T_{decay}(S)$$

<Condition 2>

$$T_{decay}(CD) < 1.5\ \mu s$$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

13. An organic light-emitting device comprising:

a first electrode; a second electrode; m emission units located between the first electrode and the second electrode and including at least one emission layer; and
m-1 charge generating layers between neighboring two emission units of the m emission units and including an n-type charge generating layer and a p-type charge generating layer,
m is an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission unit of the m emission units is different from the maximum emission wavelength of light emitted from at least one emission unit of the remaining emission units,
the emission layer comprises a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer comprises a thermally activated delayed fluorescence emitter, and
the thermally activated delayed fluorescence emitter does not include metal:

<Condition 1>

$$T_{decay}(CD) < T_{decay}(S)$$

<Condition 2>

$$T_{decay}(CD) < 1.5\ \mu s$$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

14. An organic light-emitting device comprising:

a first electrode; a second electrode; and m emission layers between the first electrode and the second electrode,
m is an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission layer of the m emission layers is different from the maximum emission wavelength of light emitted from at least one emission layer of the remaining emission layers,
the emission layer comprises a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer comprises platinum (Pt):

<Condition 1>

$T_{decay}(CD) < T_{decay}(S)$

<Condition 2>

$T_{decay}(CD) < 1.5\ \mu s$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

15. An organic light-emitting device comprising:

a first electrode; a second electrode; and m emission layers between the first electrode and the second electrode, m is an integer of 2 or more,
the maximum emission wavelength of light emitted from at least one emission layer of the m emission layers is different from the maximum emission wavelength of light emitted from at least one emission layer of the remaining emission layers,
the emission layer comprises a host, a cooling dopant, and a sensitizer, wherein
the cooling dopant and the sensitizer satisfy Conditions 1 and 2, and
the sensitizer comprises a thermally activated delayed fluorescence emitter, and
the thermally activated delayed fluorescence emitter does not include metal:

<Condition 1>

$T_{decay}(CD) < T_{decay}(S)$

<Condition 2>

$T_{decay}(CD) < 1.5\ \mu s$

wherein, in Conditions 1 and 2,

$T_{decay}(CD)$ is a decay time of the cooling dopant, and
$T_{decay}(S)$ is a decay time of the sensitizer.

FIG. 1

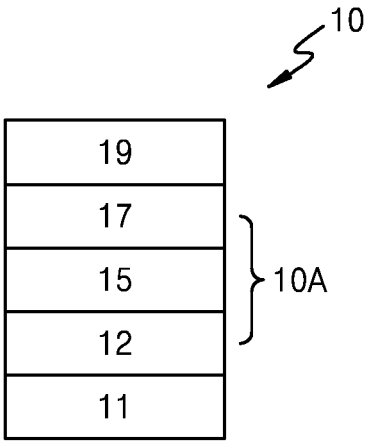

10
19
17
15
12
11
10A

FIG. 2A

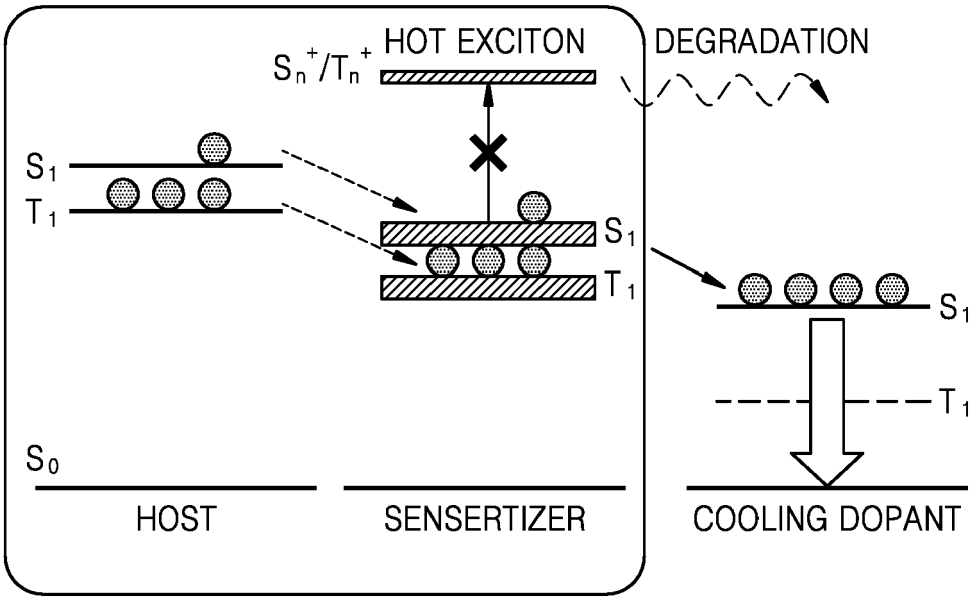

HOT EXCITON
S_n^+/T_n^+
DEGRADATION
S_1
T_1
S_1
T_1
S_1
T_1
S_0
HOST
SENSERTIZER
COOLING DOPANT

FIG. 2B

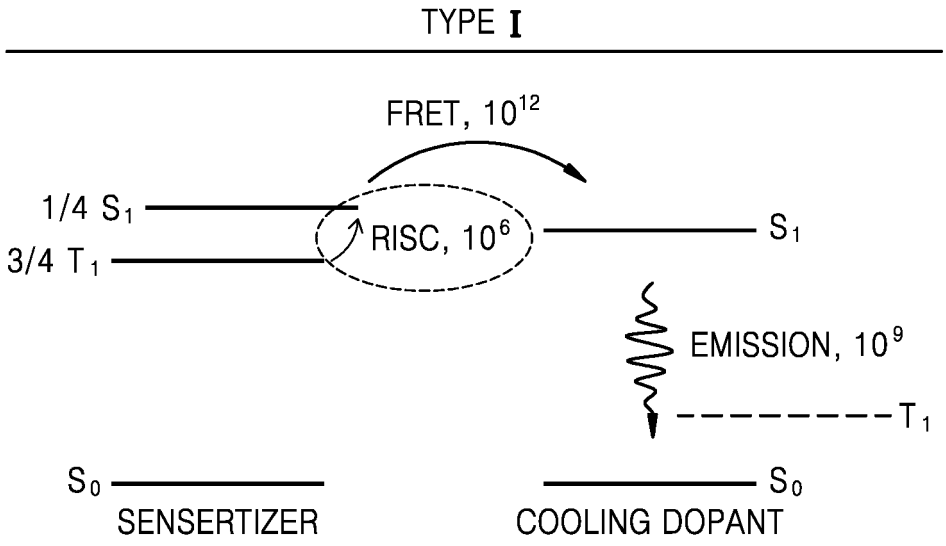

TYPE I
FRET, 10^{12}
1/4 S_1
3/4 T_1
RISC, 10^6
S_1
EMISSION, 10^9
T_1
S_0
SENSERTIZER
S_0
COOLING DOPANT

FIG. 2C

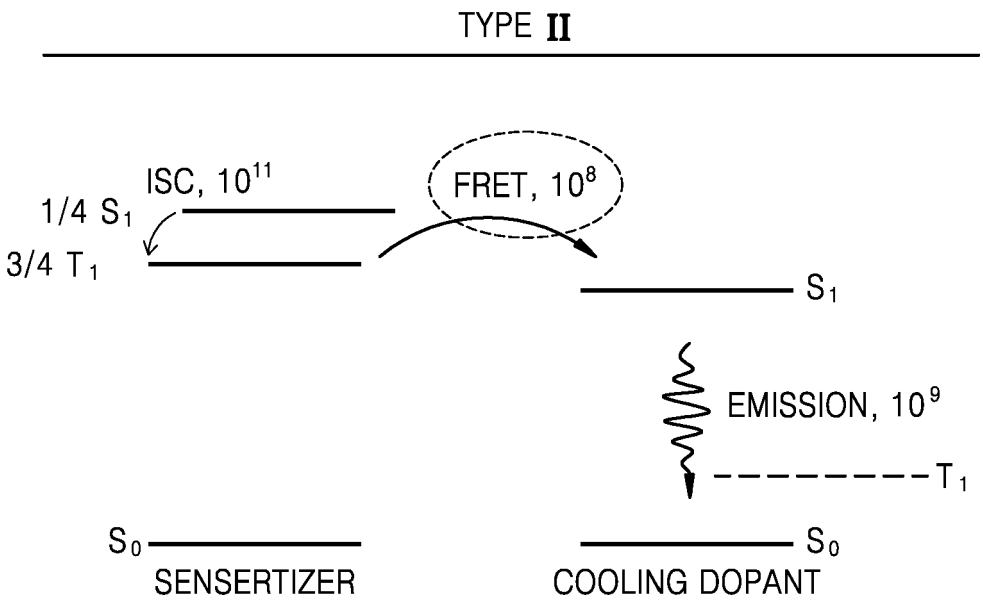

TYPE II
ISC, 10^{11}
FRET, 10^8
1/4 S_1
3/4 T_1
S_1
EMISSION, 10^9
T_1
S_0
SENSERTIZER
S_0
COOLING DOPANT

FIG. 3

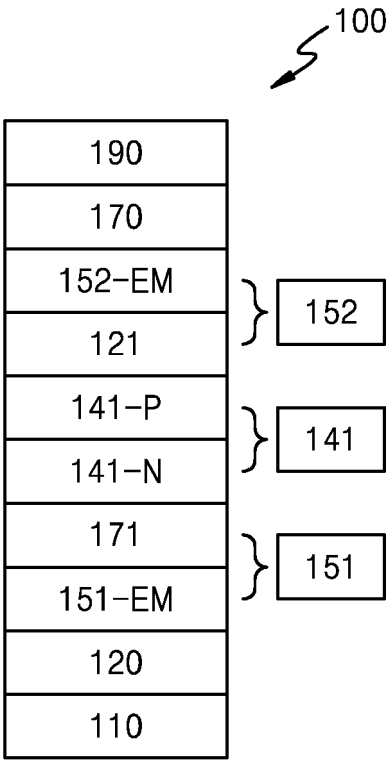

100
190
170
152-EM
121
152
141-P
141-N
141
171
151-EM
151
120
110

FIG. 4

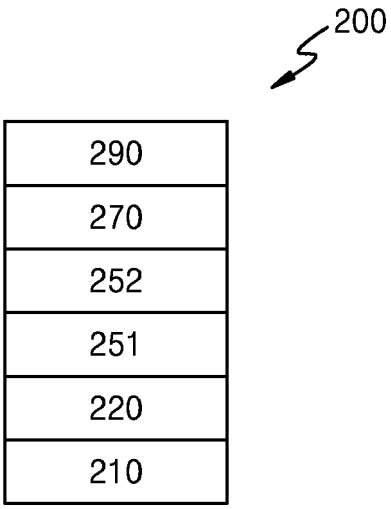

200
290
270
252
251
220
210

FIG. 5

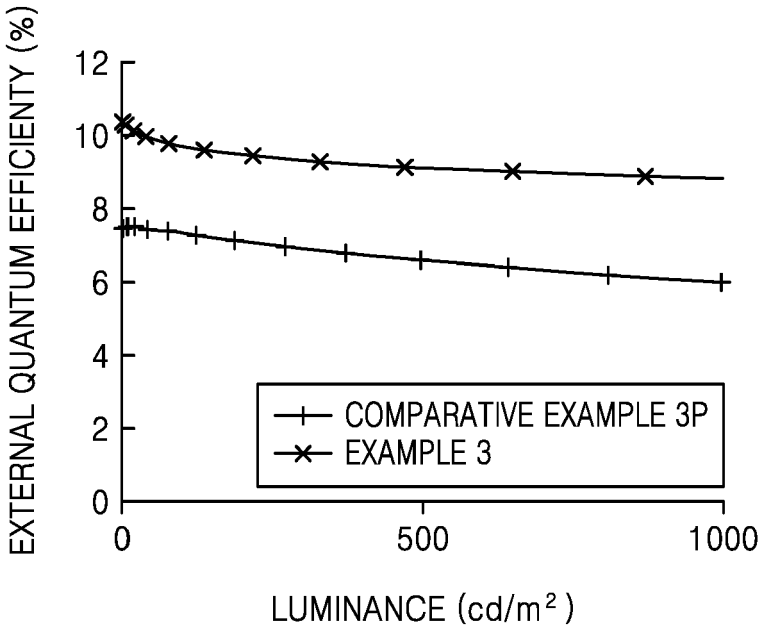
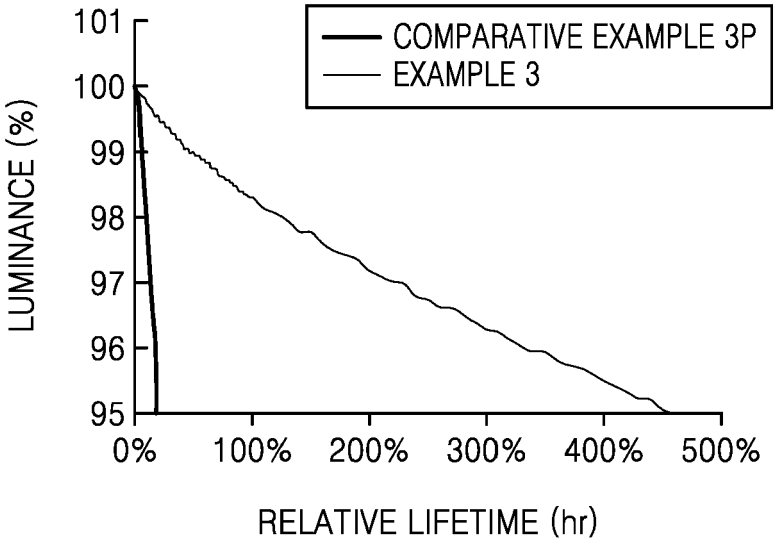

EXTERNAL QUANTUM EFFICIENTY (%)
12
10
8
6
4
2
0
0
500
1000
LUMINANCE (cd/m²)
COMPARATIVE EXAMPLE 3P
EXAMPLE 3

FIG. 6


LUMINANCE (%)
101
100
99
98
97
96
95
0%
100%
200%
300%
400%
500%
RELATIVE LIFETIME (hr)
COMPARATIVE EXAMPLE 3P
EXAMPLE 3